THE MEDICAL JOURNAL OF AUSTRALIA

VOL. I.—20TH YEAR. SYDNEY, SATURDAY, FEBRUARY 4, 1933. No. 5.

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SOME PROBLEMS IN THE DIAGNOSIS AND TREATMENT OF GENITO-URINARY TUBERCULOSIS.[1]

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THE subject of this paper was suggested to me by the number of tuberculous cases that we were finding in our clinic at the Melbourne Hospital, and in many of them, particularly those we saw in the earlier days of the clinic, we did not immediately suspect the nature of the infection.

This paper is based on the findings in thirty cases, a number too small to provide material of any statistical value, but large enough to illustrate some of the difficulties in diagnosis and treatment.

There are three main points I wish to bring out in this paper:

1. That genito-urinary tuberculosis is always part of a general infection.

2. That genito-urinary tuberculosis, like tuberculosis elsewhere, is extremely variable in its manifestations, depending in part on variations in the general and local resistance to the infection.

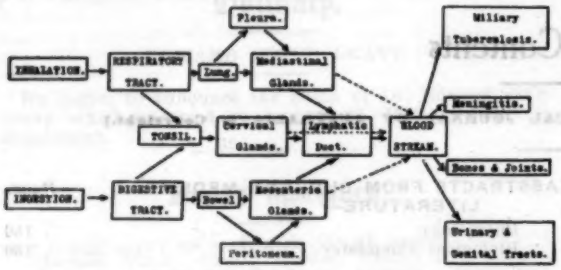
3. That genito-urinary tuberculosis is a relatively frequent complaint.

In approaching the problems of genito-urinary tuberculosis, we must first have a clear conception of the pathology of the condition and the first step is an understanding of the paths of infection. Genito-urinary tuberculosis is always the result of a blood-borne infection, and is therefore evidence of a general infection by the tubercle bacillus. In other words, it is always evidence of an earlier, and possibly still active, infection of some other part of the body.

In order to stress the importance of the paths of infection in tuberculosis, I am showing a chart, which is a modification of one drawn by R. I. Harris, of

[1] Read at a meeting of the Victorian Branch of the British Medical Association on April 6, 1932.

Toronto, in *The British Journal of Surgery* of January, 1929, and which shows the modes of primary infection and the possible directions of spread. In showing this chart I wish to stress first that the genito-urinary infection may represent a part only of the active infection in the body, as the existence of genito-urinary tuberculosis necessarily means the possibility of a general sowing.



There may still be an active primary lesion, with perhaps secondary involvement of other structures, such as bones and joints; or the primary may have healed and we may be left with single or multiple secondary lesions. It is possible that the genito-urinary lesion may be the sole remaining focus.

This chart illustrates very well the fallacy of speaking of a primary tuberculous infection of the kidney, epididymis or prostate. In so far as we mean anything by primary, we mean that the infection of the genito-urinary tract was first manifest in that situation, but we must remember that the infection spread from some other focus in the body and that that focus may be healed or may still be active, and may therefore be a bar to any operative interference for the relief of the genito-urinary infection.

Of course, the ultimate diagnosis depends on the discovery of tubercle bacilli either in the urine or in the lesion removed at operation, and that brings me to the second point raised by the chart. Seeing that genito-urinary tuberculosis is a result of dissemination by the blood, we are naturally led to inquire whether the presence of tubercle bacilli in the urine necessarily means involvement of the kidney or urinary tract. If so, does that involvement always demand surgical intervention?

It is very difficult to get any evidence on this question. The best article I have seen on the subject is that by Harris, to which I have already referred, and I think anyone who is interested in the subject of tuberculosis would be repaid by reading the article in full.

Harris shows that the finding of tubercle bacilli in the urine does mean that there is a tuberculous lesion somewhere along the urinary tract, and usually in one or both kidneys. This lesion, of course, may be small, and possibly microscopic. It is very difficult to produce any proof of this claim except in experimental animals; but a good deal of experimental work has been done which goes to confirm these opinions.

Harris himself used a method suggested by Professor Klotz for investigating this problem. From each of several patients, specimens were collected daily for ten days. Each of these daily specimens was injected into a guinea-pig and each of these pigs became infected. To quote Harris:

> Tubercle bacilli were present in the urine every day, though the patients were free from symptoms. Were their presence due to excretion from the blood-stream by the kidney, an equally constant tuberculous septicæmia must have been present. A tuberculous septicæmia so constant and severe could hardly exist without the occurrence of miliary tuberculosis. None of the patients had . . . any evidence of miliary tuberculosis. Blood cultures taken during the periods when the urine was collected were free from tubercle bacilli. It seems certain, therefore, that the tubercle bacilli came from foci of renal tuberculosis.

Harris also shows that many of these small lesions will heal, and he considers that, as we realize more fully that tuberculosis is a general infection, we will constantly be on the look out for early infection of the urinary tract and treat these early lesions conservatively.

I think that, once we realize that tuberculosis is a general infection, it becomes obvious that there will be lesions of varying magnitude occurring in the kidneys just as in other organs, and as in other organs some of these will tend to heal and others to progress. Also we must remember that, by the time that the kidney lesions have progressed sufficiently far to give rise to symptoms and for us to localize them, they are no longer early and are almost certainly too advanced for healing to take place; and this is the justification for nephrectomy, though it does not mean that nephrectomy should be done without definite indications.

At the Melbourne Hospital we have not been able to investigate the problem of the early cases of renal infection associated with tuberculosis of other organs, as we only see patients with definite symptoms of genito-urinary involvement; but Dr. Trumble has made an investigation of the bone and joint infections and the pulmonary infections at the Austin Hospital, and has been good enough to allow me to make use of his figures.

The urine of all his tuberculous patients is examined regularly for tubercle bacilli, whether genito-urinary tuberculosis is suspected or not, and in this way twelve urinary infections were discovered amongst his patients with surgical tuberculosis, and eleven amongst the cases of pulmonary infection.

These patients had no symptoms of genito-urinary infection and such infection would not have been discovered apart from this routine test.

Dr. Trumble could not tell me the number of cases investigated, so it is not possible to give percentage figures.

In a small series of forty-three cases of bone tuberculosis in adults, Harris found tubercle bacilli in the urine of sixteen, or 37%. This high percentage is in part accounted for by the fact that he used repeated inoculation of guinea-pigs; but it obviously means that tubercle bacilli were present in the urine of those patients.

These figures are given to help us to remember that genito-urinary tuberculosis is part only of a general infection, a very important fact in deciding on the line of treatment to be adopted in any particular case.

In concluding this general approach to the subject, I should like to call attention to the different prognosis in the male and the female. Given an early case, and I mean by that one with a single well defined lesion, there is no doubt that the prognosis is definitely better in the female than in the male, and the important factor is the anatomical difference in the two sexes.

In the female the genital and urinary tracts are separate and distinct, so that there is no risk of direct spread, and also a lesion in either tract can easily be dealt with radically; but in the male they are much more intimately related; with a common meeting place in the prostate, which is very liable to infection from one tract to the other by direct continuity. In addition, the severity of the operation for the eradication of genital infection and the technical difficulties are infinitely greater in the male than in the female. In our series we have not seen any cases of genital tuberculosis at the stage at which an operation to remove the focus in the genital tract could be considered. We have seen several in which there has been involvement of the epididymis and vesicles, associated with extensive involvement of the urinary tract, and with them the only reasonable plan was rest, general treatment and tuberculin.

The preparation of tuberculin that we have used has been the bacillary emulsion, "T.B.E.". We begin with about 1/20,000 milligramme and, if there is no reaction we double the dose till we reach 1/1,000 milligramme, when we proceed more cautiously. We give an injection once a week largely because we see our patients only so often; but it seems to work out reasonably well in practice. We usually discontinue injections when we reach 1/100 milligramme; but latterly we have tried 1/50 milligramme in some of our old standing cases without any untoward effect, and some of the patients have claimed to be improved. I am sure we could not prove statistically that tuberculin is of any value as our series of cases is so small; but I have the impression that those patients taking tuberculin do better than those without, and the patients nearly all claim to feel better after their course of tuberculin.

Cases Investigated.

In presenting this series of cases I wish to keep before you all the time the idea that we are treating an individual who has become infected by the tubercle bacillus; and, although our department at the Melbourne Hospital is primarily concerned with lesions of the genito-urinary tract, we always try to remember that we are dealing with a patient suffering from tuberculosis, and try to assess the importance of the particular lesion we are called on to treat. In order to do that, you must know the extent of the infection and the resistance of the patient, before attempting to advise any particular line of treatment.

I should like now to give examples from amongst our patients to illustrate the extreme variability of the manifestations of tuberculous infection of the genito-urinary tract.

First a girl, aged 24, with a very bad family history, had had a cough some months previously; but had apparently recovered; then she developed some frequency of micturition, and tubercle bacilli were found in her urine on at least two occasions. At this stage she was referred to us for examination. The general examination revealed no abnormality, nor did the examination of a twenty-four hours' specimen of urine. A cystoscopic examination was made in conjunction with intravenous injection of 0·4% indigo-carmine. There was nothing in the appearance of the bladder to suggest a tuberculous lesion, and the dye appeared in good concentration from each side in five minutes. As there was no indication of any localized lesion, one could only advise conservative treatment. She was able to go to the country and we advised her to do so, and instructed her to report immediately if she had any urinary symptoms. She was also told to see us in six months, even if she seemed perfectly well.

She came up for examination again nearly twelve months later, stating that she had had no trouble and had put on weight. We examined her again, without finding evidence of infection.

Contrast this case, in which the resistance was good and apparently the tendency was for the lesion to heal, with another.

The patient was a girl of about the same age, who came up complaining of frequency of micturition for two months. There was no history of any previous illness, and she would admit no other trouble. General examination revealed a large tender right kidney; there was also tenderness in the left loin. A cystoscopic examination was made under general anæsthesia and revealed a small red bladder. Indigo-carmine given intravenously was greatly delayed, as it did not appear on either side till after thirty minutes, and then only in poor concentration. A ureteric catheter was passed up each side and specimens were obtained. Tubercle bacilli were present in both these specimens.

She did not live long after admission to hospital, and a *post mortem* examination revealed chronic tuberculosis of the apices of both lungs, with miliary tuberculosis of the remainder of the lungs, and extensive involvement of both kidneys.

Intermediate between these two cases is that of another woman.

This patient was referred to us in December, 1929, because an X ray examination made for the investigation of a pain referred to the right hypochondrium had revealed a shadow in the region of the right kidney. She had had a cough for some time and had suffered from pleurisy, she also had a goitre. When we saw her, she had complained of frequency of micturition for ten months.

A cystoscopic examination was made and at this time her bladder capacity was eight ounces. The mucous membrane was congested; the right ureteric orifice was pale and slightly irregular, and the left was hyperæmic. A ureteric catheter was passed up each side and specimens collected, and a right pyelogram was taken, which proved that the shadow was in the upper pole of the kidney as the upper calyx was cut off by it.

The examination of the ureteric specimens came as a surprise to us, in that the right was clear and the left was loaded with tubercle bacilli.

This patient was treated conservatively and given injections of tuberculin; as, apart altogether from the question of infection of her lungs and pleura, we could not remove the active lesion on the left side. To have done so would almost certainly have caused a flare-up of the right side, which was obviously involved, though apparently quiescent.

Her condition has improved with tuberculin; though examination the other day showed that she still has an active infection of her urinary tract. The bladder capacity was again eight ounces, which is exceptionally good; the right ureteric orifice was pale and slightly swollen, with a small typical tuberculous ulcer immediately behind it. The left ureteric orifice was typically tuberculous.

It showed a drawing up of the mucous membrane, as though it had been sucked up into the ureter; and, in addition, the orifice was drawn up so that it was well above the line of the normal interureteric bar. Both of these appearances depend on the shortening of the ureter, as does an exaggeration of the movements of respiration, which is very often seen in these cases and was noticed here. Indigo-carmine injected intravenously appeared on the right side in five minutes; but in poor concentration, no dye was seen on the left side.

This patient is very remarkable in that she has put on weight during the two years that she has been under observation, and also in that she can hold her

urine for up to four hours, in spite of the fact that she is continually passing bacilli in the urine, and has actual tuberculous ulceration of the bladder.

Another case of interest was one in which the diagnosis was made at the stage when there was a solitary abscess connected with the apex of one of the calyces.

The patient had suffered from a pain in the right side and great frequency of micturition for five months; there was no history of hæmaturia. She was examined by an out-patient surgeon, who found tubercle bacilli in the urine and referred her to us.

A cystoscopic examination revealed infiltration round the right ureter. A catheter was passed up the right ureter and a pyelogram was taken, which revealed a well defined abscess at the apex of one of the middle calyces. A right nephrectomy was performed and she did very well.

This case is mentioned because, apart from the fact that it is interesting and unusual, it is typical of the type of patient who does well after operation. There was no evidence of involvement of any other system than the urinary and there the lesion was shown to be confined to one kidney, the other functioning well with no evidence of any infection.

The next case was that of a woman of 40. This age is rather more than that of the general run of our patients. When we saw her she had suffered from bouts of severe pain in the right loin for the last three months. The pain shot down to the groin, lasted about an hour, and was relieved by heat. There had been five attacks in the three months, each brought on by exertion, and accompanied by frequency of micturition. There was no scalding and no bleeding. The frequency when we saw her was constant and bore no relation to the attacks.

On examining her we found that her right kidney was palpable, but not tender. In all other respects the general examination revealed no abnormality, nor did a straight skiagram of the urinary tract.

A catheter specimen of urine contained pus, but no organisms; and, because of that, we asked her to bring up a twenty-four hours' specimen for examination. In this specimen tubercle bacilli were found.

When we examined her with the cystoscope we found that her bladder capacity was ten ounces. The mucous membrane and both ureteric orifices were normal in appearance. An injection of indigo-carmine was given intravenously and the dye appeared from the left side in four minutes and from the right side in five, a difference of no significance.

A catheter was passed up the left ureter and clear urine was obtained. Although a catheter could easily be made to enter the right ureter, its onward passage was stopped five centimetres (two inches) above the ureteric orifice, and no specimen was obtained. A right pyelogram was made with the cystoscope in position, and showed a slightly dilated pelvis with a dilated ureter running down to a stricture at the level of the tip of the catheter.

Cystoscopy was repeated seven days later, when the findings were the same; and, as before, there was obstruction to the passage of a catheter up the right side. As the appearance of the right was not definitely tuberculous, and as the function had been so good, we did a left pyelogram to determine the condition of the left kidney, which was in this way shown to be normal.

The patient was admitted to hospital and a right nephrectomy was performed. Section of the removed kidney proved the lesion to be tuberculous.

This case is somewhat unusual, and is probably an example of a tuberculous stricture of the ureter, though it is debatable whether the stricture had not caused the localization of the infection to that side. It is certain that the stricture would have been a bar to healing, once a lesion developed.

The last case illustrated dilatation of the ureter, associated with a stricture; but it is also possible to get very gross dilatation of the pelvis and ureter in tuberculous cases, apart altogether from stricture; and the patient next to be described illustrates the type in which the ureter and pelvis are dilated and rigid, instead of infiltrated and shortened, which is perhaps the more common type of change.

This patient had complained of frequency of micturition for about two years, with severe pain in the right groin. Hers was one of the few cases in which tubercle bacilli were not found in the urine, though section of the tissue removed at operation proved the tuberculous origin.

We suspected the tuberculous origin before operation, partly because the symptoms and the infection persisted in spite of treatment, and partly because of the smallness of her bladder on cystoscopy, the almost uniform redness of the mucosa, and the fact that even slight over distension made it bleed.

This smallness of the bladder, which is fairly characteristic of tuberculous cases, is now the chief problem in her treatment, as the capacity of the bladder is only about one and a half ounces.

Her condition did improve after operation, in that she lost her pain and there was for a time some reduction in the frequency; but she still has very great frequency, and the question of transplanting the ureter into the bowel was considered. This, of course, is a legitimate form of treatment if there is no infection of the kidney; but it was decided against in her case.

It is interesting to compare the last case with this next one.

The last pyelogram was done by the retrograde method; but in this case the bladder was so small and red that it was not possible to find either ureteric opening, and after intravenous injection of indigo-carmine no dye was seen from either ureter in half an hour, so that we had to have recourse to "Abrodil". The first picture was taken five minutes after the injection, and already showed the extremely dilated pelvis commencing to fill. The second picture was taken one hour later, and showed a tremendously dilated pelvis and calyces and the commencement of a dilated ureter.

This boy misled us when he first came up by not telling us that we had examined him in our department two years earlier. He gave a history of frequency of micturition for two years and, latterly, hæmaturia. Examination of his urine revealed blood and pus, but no organisms. Then a twenty-four hours' specimen of urine was examined for tubercle bacilli. A smear made at the time was negative; but injection into a guinea-pig gave rise to tuberculous lesions in the pig, as proved by a *post mortem* examination of the pig.

As mentioned before, cystoscopy revealed nothing except a small red bladder. Then "Abrodil" injection was done, and about this time it was discovered that he had attended two years earlier with obvious tuberculous lesions in his bladder and a tuberculous right kidney. No operation was done, and the results of the indigo-carmine and "Abrodil" injections apparently prove that his right kidney is no longer functioning and his left kidney is seriously damaged.

The interesting thing is the surprisingly good function in a patient who has only one kidney, and that definitely pathological. His blood urea was only 23 milligrammes per 100 cubic centimetres, whilst the "Abrodil", which can be taken as giving some guide to renal function, was excreted very rapidly and in good concentration. The indigo-carmine given intravenously did demonstrate some disturbance of function.

His chief complaint is frequency of micturition, which is due in very large part to the small capacity of his bladder, which barely holds two ounces.

It is impossible to contemplate any form of operative treatment for the relief of his symptoms, as permanent drainage would give rise to untold trouble, and transplantation of his ureter, which is so obviously damaged and infected, is not thinkable, even if he would stand the operation.

We saw just now an example of a tuberculous kidney associated with a stricture of the ureter. It is also possible to have a tuberculous infection associated with a stricture of the urethra, as happened in two cases of ours.

A man of 33 came up, stating that for six months he had suffered from frequency of micturition and pain referred to the tip of his penis. For three months he had had hæmaturia, which

persisted till we saw him. When we attempted to examine his bladder with the cystoscope, we found that he had a stricture just inside his meatus, and we were inclined to look on that as the cause of his troubles.

The stricture was dilated each week till I was able to pass a Wolf examining cystoscope. Apart from some redness of the mucosa there was no abnormality. His condition did not improve, so a twenty-four hours' specimen of urine was examined for tubercle bacilli, but none was found. Repeated examinations, however, were made, and eventually tubercle bacilli were found. Later his lesion was proved to be unilateral, and a nephrectomy was performed.

The interest in this case lies in the fact that we were led astray by the stricture which we thought accounted for his symptoms; and secondly in the mechanical difficulties which would now be overcome by using some method of intravenous urography and was done in his case when we realized the nature of the infection.

The other case with a stricture is of interest in several ways, first as showing how long a tuberculous infection may persist without causing the patient any great disability.

According to this patient's story he had injured his testicle nineteen years ago, at the age of 16, and he has had a swelling there ever since. Nine years ago the swelling broke down and the sore discharged for three months. He wore a support and got along very well till four months before I saw him, when he began to suffer from frequency of micturition and a tight feeling round his penis. The frequency increased and his urine became blood stained. He was seen by Dr., now Professor, Dew, who discovered that he had involvement of each kidney, though the left side was more seriously damaged.

I saw him in the medical ward, because he developed retention after a severe attack of hæmaturia, and the resident was not able to catheterize his bladder. With considerable difficulty I succeeded in passing a Number 7 English gum elastic catheter, which was very tightly gripped. When the bladder was entered, practically pure blood escaped, and I expected the catheter to become blocked by clot; but fortunately, by giving him fairly frequent, but quite small, washouts through the catheter, which was tied in, we got the bladder clear. I advised against any further attempt at cystoscopy, because when I saw him his right epididymis, both vesicles and prostate were definitely infected and Dr. Dew had proved that both his kidneys were involved.

On his history I would consider that he was one of the few patients we have seen in whom the genital tract was involved before the urinary; but like all other patients with genital tuberculosis whom we have seen in our clinic, his infection was too extensive to consider any radical operation, and he was treated conservatively on general lines and with tuberculin, with improvement in his symptoms.

In addition to this case with genital tuberculosis, I should like to mention two cases in which nephrectomy was done for a proved tuberculous kidney, and in each of which there was a flare up of an infection of the epididymis and cord following the nephrectomy. Both of these patients were treated conservatively, with subsidence of the swelling and relief of symptoms.

While discussing the question of resistance, I should like to refer to a patient of ours who was very much older than the general run.

He was 63 and had had very great frequency of micturition day and night for six months. There had been no bleeding. He had anorexia and had lost a great deal of weight. He was sent to the hospital as a patient with carcinoma of the prostate. His prostate was not very large, but it contained a very hard nodule, which was later shown to be opaque to X rays.

When I examined his bladder with the cystoscope I was surprised to find how small his bladder capacity was, and, on examining the bladder, that the mucous membrane was thickened and red. The right ureteric orifice was flat and normal, but the left showed increased redness of the mucous membrane and soarring with retraction. Because of the appearance of his bladder he was asked to bring up a twenty-four hours' specimen of urine. A smear made from this specimen showed tubercle bacilli. He was admitted to a medical ward soon after the cystoscopy, and died not many days after admission. A *post mortem* examination revealed an almost destroyed left kidney, a tuberculous patch in his right kidney with involvement of vesicles, bladder and right epididymis.

His case is of extreme interest in a variety of ways, and is instructive, and a warning to us to be more on the look out for tuberculous manifestations at the present time. He was a farmer from Gippsland who had fallen on very bad times, and I have very little doubt that he had an old tuberculous lesion, which had flared up under the bad conditions under which he had been forced to live.

I should like now to refer to the question of the healing of tuberculous lesions. For quite a time I had the feeling that, given good conditions, it might be possible for a tuberculous kidney to heal; and I think the history of the first patient indicates that possibility, though in her case other foci became active.

There was another patient, a woman of 27, who had a left nephrectomy performed for active advanced tuberculosis in March, 1928. She attended very irregularly and was unsatisfactory in most ways; and during the latter part of 1928 she came up with all her symptoms worse, and stating that she was pregnant. The pregnancy was terminated; and from then on, her condition has definitely improved, though tubercle bacilli can still be found in a twenty-four hours' specimen of urine.

During the time that we had her under observation, she had only one kidney which was undoubtedly involved and it has at any rate recovered very materially; and I could not help feeling that the improvement in her condition again raised the question of the possibility of healing if left alone; but I wish to give another example which was treated conservatively and ended in a catastrophe.

A woman of 29 was seen early in 1929, complaining of pain in the left loin for twelve months, with frequency of micturition for the same period, and latterly with hæmaturia. Cystoscopy revealed a generalized tuberculosis of the bladder, and also involvement of the left kidney; but, through an error in reading our notes, it was assumed that she had a bilateral infection and she was treated conservatively, with improvement till December, 1929, when she had an exacerbation of her trouble and was examined again. It was recognized then that her lesion was unilateral, and also that there was an improvement in her bladder condition. She lived in Tasmania and wished to go home, so we explained the position to her and advised her to be operated on. We did not see her till about fifteen months later, when she was very much worse with great frequency, and pain in the left loin. She was then admitted to hospital, and a left nephrectomy was done, but the wound broke down, and she developed a faecal fistula in the loin. We did not expect her to recover, but she is still alive at the Austin Hospital.

Of course, we should not let one case influence us; but this patient has cured me of any desire to be conservative, where it is a question of removing a well defined and active single focus.

The real mistake with her was in not insisting on operating when she returned on the second occasion.

I would advocate nephrectomy whenever it is possible to localize the infection definitely to one side, and when there is no evidence of active infection in any other system. I would advocate this for three main reasons; firstly, because I do not think there is any possibility of healing in any lesion that has gone on sufficiently far to declare itself to our more or less rough methods of investigation, such as functional tests and pyelograms; and, secondly,

because the constant infection by tubercle bacilli descending the ureter will cause extension of the trouble, and give rise to increasing pain and frequency; and, thirdly, to my mind, because the relief of bladder symptoms brought about by nephrectomy, apart altogether from the question of removing a focus of infection, is of value in increasing the resistance of the patients, as they are enabled to get reasonable rest.

I should like to conclude with a case showing a well defined unilateral lesion, such as I consider typical of these which do well after operation. It will also serve as a good example of our methods of examination and treatment.

A man of 37 came up complaining of very great frequency of micturition day and night for the past five weeks. On further inquiry it was found that he had suffered from intermittent attacks of pain in the left loin for the last twelve months.

General examination revealed no abnormality, his epididymes were clear, and neither kidney was palpable, nor was there tenderness in either loin. Rectal examination revealed a normal prostate; neither vesicle could be felt.

Examination of a specimen of urine showed pus and also tubercle bacilli, and these findings were confirmed by the examination of a twenty-four hours' specimen.

A plain skiagram of the urinary tract showed dense shadows at the lower pole of the left kidney. On cystoscopic examination, his bladder capacity was found to be five ounces. The mucous membrane was slightly red. The right ureteric orifice was normal, with a clear efflux; the left one was irregular, somewhat retracted and displaced. A catheter was passed up each side, and specimens were collected and sent for examination. The specimen from the right side was clear, that from the left contained pus and tubercle bacilli.

During the cystoscopic examination indigo-carmine was injected intravenously and appeared in good concentration in four minutes from the right side. No dye was seen from the left side, but on passing the ureteric catheter turbid slightly blue fluid was obtained.

I always adopt this practice of first passing the cystoscope and having a good look round the bladder before giving the dye, as it obviates any possibility of the dye coming through so rapidly that it obscures the view of the bladder. If, then, the dye is given intravenously, one has to wait only a very short time in a normal case, and it is very easy to determine from which side the dye first appears.

I have latterly tried to avoid doing a pyelogram in these cases, provided I could satisfy myself of the side of the lesion and the integrity of the opposite side, without doing so. No pyelogram was done here, as I was satisfied that the lesion was on the left side, and all the findings on the right side were normal.

After these investigations the patient was admitted for a left nephrectomy. Before deciding on operation or the anæsthetic to be used, we always get a film of the patient's chest. If the skiagram does not suggest any active or recent lesion and there are no clinical signs, we use ether; if there is any doubt, ethylene is used.

The incision adopted is the one described by Thomson Walker, and I adopt his procedure of going forward rather than upward in difficult cases. Of course, in these tuberculous cases it is necessary to go well forward, because as much of the ureter as possible has to be removed. If the patient is having ether I divide the ureter between ligatures with a cautery. If he is having ethylene I cut through with a knife and cauterize it with pure carbolic acid.

The other point that I want to bring out is that I almost invariably close the lumbar wound without drainage, that is, I always aim at doing so, and in most cases I get union by first intention.

This is a case in which this was done, and primary union has resulted, although there is a certain degree of keloid change in the scar. I have shown a photograph of the wound to demonstrate the scar four months after the operation, and also a photograph of the kidney to convey some idea of the character of the kidney after the removal of which I would consider primary suture without drainage to be safe. There is a large area of caseation at the lower pole, with a medium sized abscess in the middle calyx.

I have mentioned just now that I prefer not to do a pyelogram if I can get the information without it, and of course the obvious way to avoid doing one is to use "Uroselectan" or some similar preparation.

An objection I would raise to that is that films obtained in this way are not yet as reliable as those obtained by retrograde catheterization, and this applies particularly to children in whom, of course, the method would be of great value.

You may, however, get good results by using "Uroselectan". This is exemplified by the following case, in which Dr. Frank Stephens prepared the films.

The patient was a young man who complained of a pain in the right side and was thought to be suffering from appendicitis. Then his urine was found to be loaded with pus. An X ray examination revealed flecks in the region of his right kidney. He was then given "Uroselectan", which showed a definite lesion on the right side and a normal left pelvis and ureter. A twenty-four hours' specimen was found to contain tubercle bacilli. A cystoscopic examination was done in conjunction with the injection of indigo-carmine, which came through in normal time on the left side, but was delayed and of very poor colour on the right side. A specimen of urine from the left side was clear. After these investigations a right nephrectomy was performed, with at any rate temporary improvement.

Summary of Cases.

I should like to conclude with a brief summary of our cases.

The Age of the Patients.—Fifteen, or 50%, were between 30 and 40 years of age when we saw them. Nine, or 30%, were between 20 and 30. That is, twenty-four, or 80%, were under 40.

If an accurate account of the time of onset could be obtained in all cases, I think we could find that practically all started in the early twenties. The duration of their trouble varied from sixteen years to a few weeks, and it was the older patients who had longest the symptoms which would point to the twenties as being the period of most frequent onset. I have never seen the condition in a child, except associated with a general infection.

Frequency of Micturition.—Frequency of micturition in varying degree was present in all cases.

Pyuria.—Pyuria was a constant feature, and in many cases the examination of the first catheter specimen revealed pus without any organisms. When this happened, the patient was always instructed to bring up a twenty-four hours' specimen of urine to be examined for tubercle bacilli. If none was found, another examination was made, and usually a guinea-pig was injected.

A Twenty-Four Hours' Specimen of Urine.—The examination of a twenty-four hours' specimen of urine was by far the most helpful test. A smear from the centrifuged deposit was always made, and in our series was positive in twenty-three cases. If no tubercle bacilli were found a guinea-pig was inoculated; and in four cases the guinea-pig gave a positive result, when repeated examination of direct smears revealed no tubercle bacilli. In three cases the examination of a section of the tissues removed at operation determined the diagnosis. We have not made use of any cultural methods.

Hæmaturia.—Hæmaturia was present at some stage in twelve, or 40%, of the cases. This is probably an under estimate as it depended in a very large measure on the patients' own observations or else our observation over a very limited period.

Pain.—Pain was complained of by all our patients, either in the loin, the bladder, or in the urethra. This was a finding which surprised me.

Cystoscopy.—As regards cystoscopy, one of the most important points was the smallness of the bladder, which in many cases was also abnormally red. Another thing that should always be remembered is the ease with which these small bladders can be made to bleed by over-distension; and if bleeding does start it is usually impossible to complete the cystoscopic examination. The bleeding appears to come from fine splits in the mucous membrane.

It is rare to find typical tubercles or typical ulceration; the most important feature is the character of the ureteric orifice. Any retraction and scarring always makes one suspicious, even in the earlier stages, before the development of the typical golf hole opening.

A test with indigo-carmine should always be made, and I prefer to give the dye by intravenous injection after I have had a look round the bladder.

Pyelography.—As mentioned before, a pyelogram is sometimes necessary to determine the site and the extent of the lesion; but, if possible, I would avoid it, though there are some cases, as the one I mentioned with the abscess on the tip of the calyx, in which the diagnosis could hardly be made in any other way. In this connexion I think the development of excretion urography will be of value; but at the present time it is not sufficiently reliable, and in any case it should always be used in association with a cystoscopic examination.

Conclusion.

As I close I should like to leave with you the idea that tuberculosis is a general disease to which different patients have very varying resistance. Involvement of the genito-urinary tract is often only one manifestation and each case must be treated as a separate problem.

Acknowledgement.

In conclusion, I have to acknowledge my indebtedness to Dr. Tait for assistance, and for the free hand he has given me in dealing with these cases, and also for allowing me to use some of the material which was in the clinic before I started to work with him.

A WORKING HYPOTHESIS OF THE X RAY EFFECT: WITH SPECIAL REFERENCE TO THE SATURATION TECHNIQUE.

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So much work has been published concerning the action of X radiation upon the living cell as a unit, either *in vivo* or *in vitro*, with such a wealth of diction and contradiction, that the technical worker is in imminent danger of losing the forest amidst the trees. For the non-technical practitioner, whose daily aspirations are confined to orthodox medicine and surgery, there scarcely exists an intelligible account of the action of radiation, couched in such terms as may be readily correlated with everyday clinical knowledge. The biological effect of X rays is believed to be bound up in the production of a β-radiation composed of negative electrons. These electrons are supposedly absorbed in the cell with the production of infinitesimally small areas of excessive heat and consequent damage to the affected cell. This is the modern version of the so-called "point-heat" theory.

Another view is that precipitation of the cellular colloids may result from the negative charge carried by these electrons. Between these purely physical conceptions and the clinical X ray reaction, as we experience it, lies a wide chasm, bridged by more or less tenuous and, at present, academic theories.

It is difficult to imagine how the reaction can commence, otherwise than in the cell and therefore the importance of researches into cellular radio-physiology cannot be over-estimated. Our present purpose, however, is to emphasize the part played by tissue reactions in the ultimate effect, for it is these reactions which represent the final visible and tangible results of our efforts. We are therefore interested in the immediate cellular effects only in so far as they contribute to or initiate these tissue responses.

Normal Tissue Sensitivity.

Confining, for the nonce, our attention to normal body tissues, we find it generally accepted that their susceptibility to radiation varies with their nature and function. The following list[1] shows the relative values of the sensitivity of normal tissues to X rays in terms of the skin value as unity.

Lymphocytes	2·5
Graafian follicle	2·3
Spermatozoa	2·2
Spleen	2·1
Bone marrow	1·9
Thymus	1·8
Thyreoid	1·7
Adrenals	1·6
Skin	1·0
Intestine	0·8
Liver	0·7
Uterus	0·6
Fibrous tissue	0·5
Muscle	0·4
Bone	0·3
Nerve	0·2
Fat	0·1

From this we immediately notice that cells whose characteristics are rapid growth and multiplication and whose structure is relatively immature, appear at the head of the list, while at the bottom are the slow growing highly differentiated forms. This is in accordance with the law enunciated by Bergonie and Tribondeau. In effect they assert that young rapidly growing tissues are more sensitive than older and more matured structures, a fact amply borne out by clinical experience. During the mitotic or pre-mitotic phase, a specially susceptible stage of development occurs and this affords a partial explanation as to why growing tissues are so readily affected.

This is not the only effect, for without doubt, changes are registered in the cell at other times than during the mitotic period.

Growth and differentiation thus seem to modify the radio-sensitivity in opposite directions. It is of interest to note that these two factors are involved in all tissue development, growth being the mere increase in the number of living cells, and differentiation the building and shaping of this material to special function and structure. With plants it has been proven that most growth takes place at night, for radiation in the form of sunlight slows growth, but on the other hand promotes differentiation into leaf, stem and fibre. Hothouse fruits grown out of the sunshine are softer, larger and more succulent, but have less fibre, flavour and supporting tissue than normal fruits.[2]

Malignant tissue stands out by reason of its exuberant and disorderly growth with a great lessening or absence of cellular differentiation. In very general terms it may be said that X rays act on neoplasms by inhibiting or restraining growth and promoting differentiation, or, in other words, exercising an influence upon the cancer growth whereby it produces more adult types of tissue of lowered malignancy. These very characteristic features, excessive growth with a relative absence of differentiation, are the precise properties which render neoplastic tissue more radio-sensitive than the normal. The degree of difference between the two is generally known as the radio-sensitive interval—an interval which in general is less according as the malignant tissue approximates to the normal tissue from which it springs. An adeno-carcinoma of the rectum, for example, resembles normal mucosa closely and is a radio-resistant growth. A breast carcinoma, on the other hand, has departed greatly from the ordinary glandular structure with a reversion to more primitive cellular forms. It has lost its tissue characteristics and is therefore relatively sensitive.

The General Nature of the X Ray Effect on Normal Tissues.

The radiation effect is initiated by an action upon the cell, the exact manner of which is still subject to controversy. Whatever the actual intimate mechanism involved, it is certain that the ultimate resultant is, in the most general terms, an injury to the cell. It has been said that small doses stimulate; but, on close examination, the evidence of stimulation appears rather as evidence of tissue reaction to preceding depression and in no wise defeats the contention that radiation technically and actually injures the cell.

A tissue is a collection of different systems of cells, subject to actions and reactions whose complexity is as deep as life itself. The selective damage of one set of cells conceivably disturbs systems of poise and counterpoise, releasing inhibitions with results which may be interpreted as stimulatory in nature.

This injury to the cell is peculiar in that its evidence is delayed by a latent period of some days or weeks, but once established it remains apparent over a considerable period. Most of our accurate data in this connexion relate to skin erythemata, and skin may be taken as an example of a normal tissue. The cells mainly affected in this case are, of course, the rapidly multiplying basal layer. The onset of the erythema produced by X rays is delayed for some ten to twenty-one days, but once visible the erythema remains for about an equal period. In this respect it differs from the erythema of infra-red radiation which appears almost at once and vanishes shortly after the radiation is withdrawn, or from that of ultra-violet light which appears in two to four hours but lasts two to three days.

Lewis[3] has correlated all these vascular reactions in the skin as being due to vaso-dilator substances produced by the cell bodies themselves in response to injury, be it mechanical, thermal, metabolic, chemical, bacterial or radiant. He has labelled these substances H-bodies, because of their similarity to, or identity with, histamine, and further identifies them as being of the nature of metabolites which normally control the vascular needs of the tissues. From this valuable unifying conception, it would seem that living tissue responds in only one way to all these varied injuries, but that the time relations of the apparent result vary with the rate of development and rate of disappearance of the injurious effect. The delayed onset of the erythema from X radiation and its prolonged duration are thus due to the peculiarly slow development and the sustained character of the X ray injury. With the exact nature of this injury we are not here concerned.

Criles's work on histamine shock leads us to believe that other tissue cells as well as skin react in a similar manner, at least to mechanical injury. We may thus reasonably assume that the production of these vaso-dilator bodies in response to any form of injury is a characteristic mechanism of living tissue.

The special vulnerability of young growing tissue at once becomes a familiar fact if we consider the radiation effect as an injury, for common daily and scientific experience teaches us that the immature organism of any kind is very susceptible to damaging influences. The seedling will wilt before a hot sun which may be actually beneficial to an older plant. Explained in these general terms the differential effect of X rays ceases to be at all mysterious. The very high lability of the lymphocyte subjected to radiation would appear to rest upon its peculiar structure and function. Made for rapid multiplication and extremely sensitive to any kind of injury, it is normally a kind of physiological "cannon-fodder" designed to immolate itself in the natural defence, casting its dead body into any breach and by the

liberation of its body juices exciting tissue reactions of a protective and reparative nature.

It may be noted that from this aspect radiation produces actual biochemical bodies in the tissues poured out from the injured cells over a considerable period. The idea is not a new one, for Freund and Kaminer[4] some years ago believed that a fatty acid of a destructive nature was produced by the action of the radiation upon the nucleo-globulins of the cell.

Tissue Reactions.

Under therapeutic conditions, large blocks of tissue are radiated and single cells have no more practical existence than single atoms. The response to the insult beginning in the damaged cell spreads to tissue, to organ and even to whole organism. The sequence of events may be briefly described as a physical injury to the cell, a chemical response and a biological reaction on the part of the tissue in which the cells lie.

The usual result of tissue injury is inflammation, which in its truest sense is a reparative and recuperative effort on the part of the tissue concerned. We may note that inflammation is a function of a tissue, and not of a cell. It is impossible to visualize a single inflamed cell. That the erythematous skin resulting from radiation is an inflamed skin is obvious. Redness, swelling, pain and heat are all present if the initial insult is of sufficient intensity, the whole phenomenon being an aseptic inflammation and a stage of repair to the injury received. Histologically, the findings are those of inflammation, and even the later stages of fibrosis and cellular degeneration seen after heavy radiation are adequately paralleled by other end results from toxic and bacterial injuries.

Summarizing our conception of the action of radiation upon normal tissues, we may say that it is a slowly developing and sustained injury of uncertain nature primarily inflicted upon the cell, and hence causing inflammatory reactions of a healing nature in the tissues concerned. The actual connecting link between the primary cell damage and these reactions is the slow elaboration of H-bodies and perhaps of other disintegration products from the injured cell units. These bodies are produced mainly by the more radio-sensitive cells, such as the lymphocytes, for in such cells the injury is greatest.

Add to this that the beam of rays penetrates and pervades the whole part affecting every tissue in its path; and we have a compound effect leading to the disturbance of the specific function of organs, each organ producing its own characteristic injury syndrome and leading finally to constitutional disturbance. There is no doubt that X ray sickness is largely due to the production of these H-bodies in excess. Heavy dosage to a large radio-sensitive tumour may literally kill the patient by flooding his system with poisonous disintegration products. Furthermore, in the X ray treatment of some diseases such as asthma, it is highly probable that these injury products play some part in modifying a condition of allergy or in provoking a mild curative form of protein shock. In addition, it is conceivable that the inflammatory reaction incited may serve to combat directly other pathological forms existing in the radiated tissues at the time of treatment.

The Differential Effect Upon Neoplastic Tissue.

The actual physical effect upon a malignant cell is the same as upon the normal and the nature of the resulting injury is identical. But the characteristics of new growth being cell multiplication with the production of more embryonic cellular forms, the intrinsic capacity of the malignant cell to sustain the damage is much less.

Secondly, the capacity of the malignant tissue as a whole to stage a reparative inflammation is greatly diminished, or absent. A cancerous growth is a caricature of the normal tissue from which it springs. Cell forms are atypical and immature, supporting stroma are ill-developed, blood vessels are thin walled and scanty, and nerves are presumably absent. The mutual adaptation and intelligent cooperation of reparative effort which exist in normal structures, are deficient or, in extremely malignant growths, absent, and the healing of the injury cannot go on in the same way or at the same rate. The final resultant is that the malignant growth from the same dosage accumulates a greater degree of damage than the surrounding normal, always lagging behind in the process of recovery. The greater the malignancy the more pronounced the difference.

A third and most important aspect of the question is that the radiation has also aroused an efficient inflammatory reaction in the immediate surroundings of the neoplasm, stimulating the predatory tissue cells to attack the moribund growth.

This inability of the neoplasm to organize an efficient reparative reaction is probably the chief determinant of the degree of the radio-sensitive interval. Moppett[5] has recently published an account of a research during which he found that the cancer cell in tissue culture was more resistant than the similarly cultured fibroblast. *In vivo*, he found this result entirely reversed, the neoplastic cell being now much more sensitive. The explanation would appear to be that, in the first case, *in vitro*, he merely tested the intrinsic resistance of the cells to radiation in that particular environment and the cancer cell, being of a type habituated to culture life, won.

On the other hand, *in vivo*, the cancerous tissue had to compare, dose for dose, with normal tissue able to react efficiently to injury and furthermore activated to attack the cancer itself.

This research clearly indicates the reserve with which we must apply tissue culture experiments to clinical problems and emphasizes the importance of the tissue reaction (as apart from the initial cellular injury) in modifying the final result. It would seem that a consideration of the secondary tissue reactions has more immediate clinical importance than a study of the immediate cellular effect.

Some Elaborations.

So far our thesis is that the X ray effect is of the nature of cellular injury and that the resultant tissue inflammation is reparative in character—that the injury is greater in malignant cells, but the recuperative capacity of the neoplasm is less because of its poor tissue organization.

This is on fairly safe ground, but we may now proceed to elaborate in a somewhat more hypothetical fashion. It is not a very radical thought to imagine that the H-bodies or other chemical substances, produced by the radiation effect, are themselves toxic and injurious if not removed from the tissue spaces. There are other examples in the human economy when the accumulation of metabolic products is definitely harmful. The beneficial effect of the inflammatory reaction would seem to be largely an increased vascular flushing of the affected area, carrying off these injurious products or neutralizing them. Thus, malignant tissue, producing these H-bodies in great concentration and failing to organize a good reaction, would be at a great disadvantage as compared with its normal surroundings. A logical deduction is that the effect of the dose would take longer to evaporate.

Radio-Resistance.

The validity of any hypothesis is best judged by its ability to explain the accepted empirical facts and we may thus test our conclusions.

Clinically it is definitely proven that repeated radiation of a tumour tends to increase its radio-resistance, and the explanation in terms of this hypothesis would appear to be that the tissue reactions of both the normal and the malignant elements have become exhausted. With increasing dose the sensitive cells die off and only the more radio-resistant elements remain, and even the growth of these is for the time inhibited. But in addition, the whole area has suffered a certain degree of damage, and finally a stage comes when even the normal tissue has exhausted its capacity to react. Both neoplasm and normal tissue have tended towards a common state of injury in which the reparative reaction of the normal tissue is no better than that of the neoplasm, and the radio-sensitive interval has vanished. It is probably still possible to destroy the neoplasm by increasing the dose, but only at the cost of necrosing the normal tissue as well.

This happens because the radiation has been too long drawn out, with the infliction of a timid, insufficient dosage at prolonged intervals, which damages the normal components without at any time extending their reactionary potentialities. The essence of the differential X ray effect upon the neoplasm is the sharp and bold assault which contrasts the lusty response of normal virgin areas with the debilitated efforts of the growth.

Once destroyed by paltering dosage the virginity of the tissue response is gone for ever and it never has the same vigorous reparative urge, enabling it to withstand radiation which is lethal or inhibitive to the poorly organized tumour.

Hence the importance of adequate skilled and efficient treatment in the first instance, for the therapeutic opportunity as elsewhere "presenteth a bald noddle behind", and no amount of dosage later will make up for the careless wastage of these tissue capabilities in the commencement. We must strike, and strike hard, whilst the iron is hot, not wasting our energies after it has cooled off. The "radio-resistant" growth is only too often the product of a hesitating and faltering method of administering the dose.

Much the same considerations explain the poor response of a growth in a septic environment, for here we deal with tissues injured and exhausted before we commence. The rational procedure would seem to be the treatment of the septic condition first, and if possible, the lapse of a short period to allow of tissue recovery.

A further consideration of these principles will enable us to realize the paramount importance of a good blood supply to the radiated area to insure that the incited tissue reactions reach their utmost efficiency. In general, in proportion as the capacity for tissue reaction is diminished, so fall the potentialities of radiation therapy.

This defect in the tissue may be due to a previous pathological process, such as syphilitic endarteritis, to surgical trauma, to sepsis, to poor blood supply, or even to previous radiation. The end result is the same in every case—apparent radio-resistance. The concept of tissue reaction, as a reparative response to the injury, thus seems capable of assimilating some of the empirical findings of radiation therapy.

The Time Element.

From the foregoing it would seem advisable to give all our radiation in one massive dose in order to avoid the development of the radio-resistant phase. But other equally important factors are concerned which operate in the reverse direction. Given an injury to a normal tissue, within viable limits, we might expect the injurious effect to evaporate in accordance with definite laws. Kingery[6] has published some work on this subject in connexion with skin therapy, using unfiltered radiation.

Assuming the formation in the tissues of a hypothetical decomposition product, he has calculated that the given effect decays at a rate proportional to the concentration of this product. Thus with an initial 100% dose and a 10% rate of decay on successive days we should have effects persisting equal to 90%, 81%, 72·9%, 65·6% *et cetera*, each day's effect being 10% less than the preceding day's.

If Z_0, Z_1, Z_2, Z_3....$Z_{(t-1)}$, Z_t be the concentrations after time intervals of 1, 2, 3....(t−1), t, and if a be the ratio of effects on any two successive days, then

$$\frac{Z_0}{Z_1}=\frac{Z_1}{Z_2}=\frac{Z_2}{Z_3}=\ldots.=\frac{Z_{(t-1)}}{Z_t}=a.$$

Multiplying all these and cancelling, then

$$\frac{Z_0}{Z_t}=a^t.$$

$$\therefore \log Z_0-\log Z_t=t \log a \quad \ldots\ldots\ldots\ldots (1)$$

If the initial dose be 100 and t be the time the effect takes to decrease to 1%, then

$$\log 100-\log 1=t \log a$$

$$\therefore 2-0=t \log a$$

$$\therefore t=\frac{2}{\log a}$$

Log a is the so-called velocity of reaction. Given a we can calculate the theoretical concentration Z_t at any time t from the equation (1), for, calling Z_0 100%, then $\log Z_t=2-t \log a$.

For skin with unfiltered radiation, Kingery found that the effect almost completely disappeared in fourteen days and diminished to 50% in three and a half days. Pfahler[7] has applied the principle to short wave radiation produced at 200 kilovolts peak, and has published a curve of decay of the dosage effect in skin showing a rate of 7% *per diem*. Mattick and Stenstrom[8] produced a research indicating 8% as the correct figure under approximately the same conditions. These figures all apply to skin.

Owing to the constant tendency of the tissues to recover from the radiation effect, if the dose is spread over a longer time, either continuously or in fractions, it becomes necessary to add more radiation to produce an equivalent effect. Numerous figures in this connexion have appeared relating to skin erythema, of which the following are the best known. The table shows what amounts of radiation spread over a given time produce an erythema equal to 100% dose given in one day. Three authorities are indicated.

TABLE I.

Levitt.[9]	Mattick and Stenstrom.[8]	Reisner.[10]
Equal Daily Fractions.	Four Fractions at Equal Intervals of Time.	Equal Daily Fractions.
150% in 6 days.	120% in 5 days.	130% in 2 days.
220% in 14 days.	130% in 8 days.	150% in 3 days.
250% in 21 days.	140% in 10 days.	160% in 4 days.
280% in 28 days.	150% in 14 days.	210% in 7 days.
		240% in 12 days.
		270% in 27 days.

Levitt and Reisner agree well enough, but Mattick's findings appear unduly conservative. For the calculation of dosage decay, however, the conservative estimations are the safest in our present state of knowledge. I have therefore adopted Pfahler's figure of 7% *per diem* and constructed a curve similar to his from equation (1), which becomes

$$\log Z_0 - \log Z_t = t \log \left(\frac{100}{93}\right) = 0{\cdot}0315t$$

and is represented in Figure I. Such a curve applies

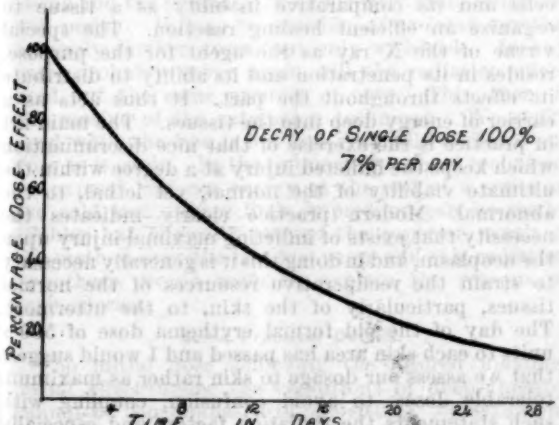

FIGURE I.

reasonably well to the effects of radiation produced at 200 kilovolts peak with one-half to one millimetre copper filter. At any time after a dose, from such data we can estimate the percentage effect remaining, and hence the additional dose necessary to raise the effect once again to 100%.

Any such curve can, of course, only approximate to the complex phenomena doubtless involved. It would apply only to virgin skin over a limited extent both of dose and of time. Obviously, as the radiated tissue suffers increasing damage, the rate of decay of the dose, which is the expression of the tissue's recuperative power, must diminish.

All these time data relate only to skin. There has been a presumption, which is probably not correct, that they are valid for other parts of the body. Clinically we know that different parts of our anatomy heal at different rates. The veriest tiro in surgery does not expect the same healing in a foot as in a scalp. A cancerous growth once injured will seldom show sign of healing at all, and it is probable that varying tissues throw off the radiation effect at varying rates in proportion to their general capacity to resist injury. From the foregoing it is submitted that malignant tissue recovers at a much slower rate and hence accumulates the injury as time goes on.

To illustrate arithmetically, let us imagine two tissues N (normal) and M (malignant) which lose the dosage effect at the rates of 10% and 5% *per diem*, respectively. Suppose now to each of these tissues we give 100 units, the maximum permissible amount of radiation which can be given in one dose. It is assumed that this maximum is the same for both N and M, which might not necessarily be so. The assumption of a common maximum, however, is parallel with clinical conditions where our maximum tolerable dose is always that of the normal components.

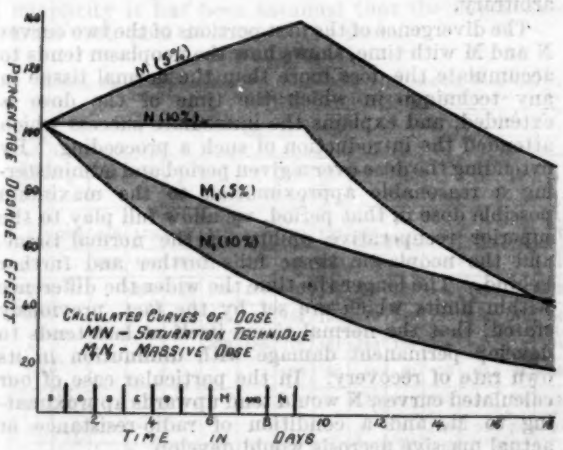

FIGURE II.

The curves of the subsequent decaying dosage effect day by day will then be N_1 and M_1 in Figure II, and the difference of the injury effect in the two tissues will be represented by the area between the two curves. It will be noted that only momentarily is the injury effect at the maximum permissible 100% and thence it rapidly decreases.

Let us now calculate and plot the result of a separate experiment (Figure II, N and M). After giving the 100 units to each, at the end of twenty-four hours N has lost ten units and M only five. Suppose that day by day we add ten units to each of them, thus keeping N saturated at 100. The dosage effect in M will gradually rise as it only decays at the rate of 5% of the existing total per day, until such time as 5% of the total accumulated in M, equals the daily ten units added, that is, till M accumulates 200 units, N remaining at 100. The two curves typify what happens when daily doses are added to keep a neoplasm saturated, estimating the daily additions on the known recuperative rate of normal tissue. It is, of course, not possible to go on indefinitely adding saturation doses, as permanent tissue injury would develop long before the maximum difference in N and M was attained. In practice it seems possible according to Pfahler to maintain saturation for ten to fourteen days with recovery of the normal. Our curves show only nine days, after which radiation ceases and the decay at the rates of 10% and 5% is again plotted for each tissue.

The area between the curves N and M again represents quantitatively the extra effect upon the neoplasm. It is much greater than the area N_1M_1, and what is also of great importance, a considerable part of the area lies above the 100 units, as opposed to the area N_1M_1, which is entirely below this level. The effects are not strictly comparable as to dose. In the two lower curves, typical of the old massive dose technique, 100 units are given, in the upper, approximating to the modern saturation technique, 190 units are given. However, it demonstrates the principle, as in each case the maximum permissible dose under the particular technique is administered. It is emphasized that the actual values chosen are arbitrary.

The divergence of the first portions of the two curves N and M with time, shows how the neoplasm tends to accumulate the dose more than the normal tissue in any technique in which the time of the dose is extended, and explains the immediate success which attended the introduction of such a proceeding. By extending the dose over a given period and administering a reasonable approximation to the maximum possible dose in that period, we allow full play to the superior recuperative ability of the normal tissue, and the neoplastic tissue falls further and further behind. The longer the time the wider the difference within limits which are set by the fact, previously stated, that the normal tissue itself at last tends to develop permanent damage with diminution in its own rate of recovery. In the particular case of our calculated curves, N would tend upwards approximating to M, and a condition of radio-resistance or actual massive necrosis would develop.

With increased time it becomes possible to administer a greater maximum tolerable dose. To secure adequate radiation effect it is necessary to take full advantage of this capacity, otherwise the intensity of the dose per unit of time may fall much below that required to produce results. With indefinite extension of time without adequate increase of the total quantity of radiation given, the intensity of radiation may fall so low that the tissues throw off the effect as fast as it is administered and no result ensues. The radiation may then be said to be below the threshold intensity. The quantity of X rays with which the human body as a whole can deal in this way under daily working conditions without evidence of injury is variously given as from 0·2 to 2 international *r* units per day.

Research work[11] is at present progressing on the application of X rays to the whole body at rates of approximately one *r* unit per hour; the idea apparently being that widespread metastases will accumulate the dose slowly, whilst at this low level normal tissues will throw off the dose as rapidly as it is received. Theoretically, with this object in view, it should be possible to maintain normal tissue at very low levels of dosage effect over very long periods without any depreciation of their recuperative rate. Unfortunately the degree of the differential effect upon the malignant tissue seems to be a function of the actual total radiation effect present. Hence the differential effect would be small also and such a research would seem doomed to failure. Again, such low intensities will fail to excite those vigorous tissue reactions seen to be so important.

Time is thus an extremely important factor to be considered in assessing the action of any radiation technique. Obviously this action of time in increasing the residual effect in the neoplasm will be present in some degree, whether the administration is continuous or merely fractionated at intervals, as is so common today. The defect in most present-day X ray technique, when the radiation is equally spaced over a period of time, is that complete saturation of the tumour occurs only towards the end of the course. This may be three or four weeks and by that time the capabilities of the tissues are on the wane, with a great decrease of the differential effect.

The Object of the Author's Therapy.

The basis of X ray therapeutics is thus the infliction of a judicious injury upon all the tissues in the path of the beam. It is a selective injury in that all pathological or malignant tissue suffers more damage than the normal owing to its intrinsically unstable cells and its comparative inability as a tissue to organize an efficient healing reaction. The special virtue of the X ray as the agent for the purpose, resides in its penetration and its ability to distribute its effects throughout the part. It thus acts as a carrier of energy deep into the tissues. The main art in practice is the exercise of that nice discrimination which keeps the inflicted injury at a degree within the ultimate viability of the normal, yet lethal, to the abnormal. Modern practice clearly indicates the necessity that exists of inflicting maximal injury upon the neoplasm, and in doing this it is generally necessary to strain the recuperative resources of the normal tissues, particularly of the skin, to the uttermost. The day of the old formal erythema dose of 500 *r* units to each skin area has passed and I would suggest that we assess our dosage to skin rather as maximum tolerable doses, to avoid confusion, coupling with such statements the radiation factors and especially the time over which the total dose is administered.

Very few publications afford a complete and comprehensive prescription of the dosage and radiation employed. Large doses are being increasingly used. Coutard[12] gives up to six skin erythema doses, over three to four weeks; Stewart mentions a dose of 2,400 *r* (international) without specifying the exact time duration, but remarks that this does not extend the recuperative capacity of the skin entirely. We recently gave this dose spread out over three weeks to a superficial carcinomatous nodule through a field of ten square centimetres. As it was a superficial lesion, low voltage and a filtration current of 180 kilovolts peak, and a filter of 0·3 millimetre copper and one millimetre aluminium were employed. The area had four months before been heavily irradiated, sufficiently to produce a peeling reaction. The result of this second dose was a bluish blistering reaction, which healed in three weeks, leaving skin normal to sight and touch. Medical men dealing with patients who have been irradiated must realize that a vigorous and uncomfortable reaction is necessary in many cases of malignant disease and that such a reaction is not necessarily evidence of error on the part of the radiotherapist.

In addition to administering an adequate total of radiation, our therapy must steer a course betwixt Scylla and Charybdis. Too long a period of time tends to radio-resistance, too short a period fails to exploit the superior recuperative power of normal tissues. The importance of the first reactions of virgin areas and the evanescence of their potency with repeated dosage have been noted.

The ideal method would therefore seem to be one which, with a sharp initial blow, arouses the latent powers, extending them to their uttermost, whilst fresh and unspoiled, and which then maintains this maximal effect by recurrent smaller stimuli. This process is maintained just so long as we think the normal tissues can tolerate it without permanent damage or tissue exhaustion. In practice this is about fourteen days with a maintained retention dose of about 800 to 850 *r* (international) at the level of the tumour. Any further dosage is then very akin to flogging a dead horse, for radio-resistance is commencing. Time and rest will now restore the healthy tissue and the neoplasm, if sufficiently radio-sensitive, will perish. It may be possible, after some months, to apply further doses, but only with risk. In any case, probably never again will the radiation effect hold out the same promise of cure. This, then, is the motive of the saturation technique. We strike hard while the iron is hot and gradually decrease our dose as it cools. In the ordinary fractional technique we expend half our energy at the end of a series on the cold iron, where little impression can be made. Pfahler has clinically proven the superior worth of the method over the last few years and this radiation hypothesis would seem to explain the reasons of such success.

Some Practical Details.

The initial dose achieving the desired maximal initial effect under the conditions of deep therapy cannot be consummated in one sitting. The tumour often lies deep in the body, and to achieve 100% dose into its substance in one session would involve too grave a constitutional disturbance, owing to the large masses of intervening tissue perforce radiated. But even with the thickest parts it is usually possible to reach initial saturation within five to seven days. In smaller parts or in more superficial lesions, saturation may be accomplished in one or two days. In any case, this primary saturation should be completed in as short a time as possible, giving full consideration to the necessity of conserving the general health and resistance of the patient.

For example, in a pelvic lesion with four ports of entry, and with a depth dose equal to 40%, daily doses of 500 *r* units successively to each port of entry will result in a total effective depth dose of 870 *r* to the lesion (allowing for decay of the effect at the rate of 7% per day) in five days.

For the calculation we can express the dose both superficial and deep, in *r* units, and the progressive dosage effects persisting in the tissues can be integrated as equivalent to so many *r* units also, using for the calculation the 7% decay curve or the same data made up in tabular form. This 7% allowance will truthfully express the decay of the dose in the skin. We assume it approximately correct for the deep normal tissues, knowing that it is incorrect for the tumour, which loses the dose more slowly with results previously discussed.

Daily doses of 500 *r* to each of four ports of entry with 40% depth dose to the level of the lesion will mean that each daily session administers 200 *r* to this level. The sequence of events may be shown in the attached table, where the initial figure opposite each port represents the deep dose actually administered, and subsequent horizontal extensions the decay day by day. Vertical additions will total the effect present on any day. The superficial doses, to avoid complication, are not inserted. For further simplicity it has been assumed that the depth dose from each port of entry is the same.

TABLE II.

Showing the Basic Principle of Calculation in the Saturation Technique. Saturation shown Maintained for Nine Days only.

Port of Entry.	Day of Treatment.													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	**200**	186	173	161	150	139	129	120	112	104	96	89	83	77
B		**200**	186	173	161	150	139	129	120	112	104	98	89	83
C			**200**	186	173	161	150	139	129	120	112	104	96	89
D				**200**	186	173	161	150	139	129	120	112	104	96
A					**200**	186	173	161	150	139	129	120	112	104
B							**100**	93	86	80	75	68	64	60
C									**120**	111	103	96	89	83
D											**100**	93	86	80
B													**100**	93
D														**80**
	200	386	559	720	870	809	852	792	856	795	839	778	823	815
	Total effective dose at the level of the tumour.													

It has been noted that saturation at the figure of 870 *r* is attained in the fifth day. Once this is attained daily treatments cease; the calculation of

the decaying effect is continued and at intervals of two, three or more days the deficit is made up, using the same skin ports of entry, taking care that in no case does any area of skin receive an excessive dose. Saturation is thus maintained for ten to fourteen days, and then radiation ceases.

Our records have thus to keep tally of a number of quantities for each field. These are: (*a*) the actual doses delivered to the skin; (*b*) the actual summated dose in the skin at any one moment allowing for the decay; (*c*) the actual summated depth dose at the level of the tumour, at any moment from this field, also allowing for the decay. This will necessitate an estimate of the percentage dose arriving at this level, and such must be attained by a combination of anatomical knowledge and the use of published or experimental tables of depth values corresponding to the constants of the radiation used. In addition we must have (*d*) an integration of all the persisting depth effects from all the fields, obviously a multiple of (*c*). This gives the total existing effect at any moment in the tumour from all fields. All this can be easily and quickly achieved with the use of a special card we have designed and the use of all data in tabular form. Such a card is preferable to the use of the graphs shown in Pfahler's article.

In addition to the special biological advantages inherent in the method, the attention is concentrated on the dosage in the tumour, whilst at the same time all skin values are efficiently recorded. Too often the radiotherapist is only concerned to estimate and safeguard his skin dose, forgetting that the estimation of skin values is but a means towards inflicting maximal punishment upon the growth. The method keeps one's "eye on the ball".

Disadvantages.

The disadvantages of this method are relative. The use of heavy dosage in short time calls for efficiency and careful measurement. Radiation once given cannot be recalled or neutralized. It makes a heavier call on the patient at first, but such call occurs when the patient is fresh, and in any case is warranted by the superior results.

The dose can only be repeated within any practicable time with great caution. The method uses up all the potentialities of the tissues in the first series and leaves no margins, but this single series achieves better results than do wearisome repetitions of rapidly decreasing utility.

The method is applicable only to the therapy of malignant disease.

Summary.

1. A working hypothesis of the X ray effect has been put forward.

2. Deductions have been made from this hypothesis in explanation of the known biological superiority of the saturation technique.

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THE TREATMENT OF ADHERENT AND DEFICIENT PALATES.

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OUR objects in drawing attention to this subject are:

1. An earnest endeavour to increase the efficiency and to improve the results of accepted methods by the substitution of a new procedure—that of using a fixed splint to prevent readhesion of the soft palate to the dorso-lateral aspects of the pharyngeal wall.

2. To impress the necessity for treatment of such deficiencies and irregularities of the palate before gross pansinusitis or *otitis media* occurs.

3. To stress the need for exercising extreme care in removing children's tonsils and adenoids.

4. To emphasize specially the medico-legal aspect of these cases.

In 1923 Brophy stated that:

> *Atresia palati* has received little attention on the part of surgical writers. The literature of the subject examined furnishes but few references to this abnormality.

This statement holds good at the present time. Practically no detailed references are to be found in the literature available.

Brophy further said that:

> When the palate is separated from the posterior pharyngeal wall it is certain to reunite unless some substance is introduced to prevent union until the freshened surfaces heal. Improvement without surgical treatment is impossible.

Adherent and deficient palates result from disease or trauma, but we are directing attention to those resulting from trauma, usually operative.

The distress occasioned by even the minor degrees of palate deficiency (for example, the so-called "bowstring palate") may approximate to that caused by total atresia. This includes nasal voice, retention of nasal discharge, and pansinusitis. The patient finds it impossible to blow the secretions from the nose, and the continuous nasal discharge produces an irritative dermatitic condition about the anterior nares.

Ætiology of the Adherent Palate.

As a preliminary to discussion of treatment and prognosis it would seem wise to detail the events leading up to such abnormalities, and later to give the example of three cases, the treatment of which will demonstrate our improved technique in contrast with usual procedure.

Tonsillectomy.

Firstly we shall consider tonsillectomy. In a recent protracted discussion in our journals as to the relative merits of tonsil guillotining and dissecting, the main factor as far as the patient is concerned seems to have been neglected, namely, that the end result should give absolute freedom from symptoms which necessitated operation, absence of gross and unnecessary scarring, and that the field of operation should be left in as normal an anatomical state as possible.

The dangerous sequelæ result from: (i) anatomical and pathological states, (ii) anæsthetic complications, (iii) surgical complications, (iv) poor technique resulting from various causes to be detailed.

Anatomical and Pathological States.—Among anatomical and pathological states may be included the following:

(*a*) The presence of the so-called "lingual tonsil" which frequently results in bleeding, the control of which may determine a shortening of the posterior faucial pillars, resulting in "bowstring palate", or even an adherent palate.

(*b*) Irregularities of anatomical features due to peritonsillar abscess, with scarring, especially about the supratonsillar fossa.

(*c*) Adhesion of tonsil to the faucial pillars.

(*d*) Shrunken fibroid tonsils, either due to primary inflammation, or inflammation secondary to cauterization or diathermic coagulation.

(*e*) Abnormal blood vessels, present prior to the inflammatory state, or resulting therefrom.

Anæsthetic Complications.—We shall not enter into the ever present controversy as to the choice of anæsthetic agent, but shall insist that whenever general anæsthesia is employed there should be relaxation of the faucial pillars, absence of anæsthetic spasm, free air entry and absence of excessive mucus.

In this connexion we recall a dramatic incident:

A careless anæsthetist, using a Junker's apparatus and connecting his tubes incorrectly, pumped liquid ether into the pharynx. Fortunately the patient's head was low, and the nasopharynx was quickly cleared of approximately two ounces of ether. The extreme cyanosis disappeared and the patient breathed normally after some minutes of artificial respiration. The operation was then performed and the resulting hæmorrhage was excessive, one supratonsillar vessel giving much trouble. The convalescence was uneventful, except that some palatal slough occurred from the manipulation necessary in arresting the hæmorrhage. The resulting deficiency caused regurgitation of fluids through the nose and a very nasal voice. These conditions persisted for some months. The only permanent sequela was the irregularity of the palate, which was unsightly, but functionally perfect.

The lessons learned from this case were the necessity for anæsthetic care, and the conclusion that, in the event of a similar accident, it would be preferable to postpone operation for some days rather than risk gross bleeding.

We certainly feel that mask anæsthesia is usually sufficient in children, but that some form of continuous anæsthesia is necessary in adults.

Surgical Complications.—The main surgical complications are due to adhesions of tonsil or capsule to the faucial pillars or palate, scarring and adhesions due to recurring peritonsillar abscess, shrunken fibroid tonsils or the presence of lingual tonsil. These abnormal conditions tend to the production of hæmorrhage which is, especially in the very fibroid cases, difficult to control. The greatest difficulties in arresting hæmorrhage are necessarily experienced at the most caudal limit of the tonsil or about the supratonsillar fossa, where the resulting manipulation may cause some palatal slough.

Poor Technique.—Here many factors must be considered:

(*a*) Primarily an unskilled operator or one who, regarding the operation as a minor one, foolishly fails to perfect whatever technique he has chosen to employ.

(*b*) The employment of an operation unsuitable for the particular case under notice.

(*c*) Anæsthetic difficulties.

(*d*) Hæmorrhage.

(*e*) Unsatisfactory conditions as regards trained assistance, equipment, illumination, and the correct position of both patient and surgeon.

(*f*) The non-recognition of the absolute necessity for working under direct vision. Whether daylight, frontal mirror, focussing lamp or shadow-free lamp be employed is immaterial, providing it be definitely understood that tonsillectomy must be done under the surgeon's sight, not by palpation or any other haphazard method. These latter often result in the loss of the uvula—a most unnecessary mutilation.

Here we would take the opportunity of condemning the practice, which is all too popular, of performing these operations in private houses, under poor conditions, as detailed above. Though we recognize the impossibility of always avoiding such undesirable conditions in some practices we would still emphasize that an endeavour should be made to obtain ideal theatre accommodation for this operation, or at least to approximate thereto.

(*g*) Lastly, failure to examine the patient's throat immediately after operation, and several times during convalescence. By this procedure adhesions can be avoided or dealt with more easily than at a later date. Also, when palatal deficiencies are present, their degree can be accurately estimated with a view to immediate or late operative treatment.

Adenoidectomy.

Secondly, concerning adenoidectomy, dangerous sequelæ result from the same causes as specified in connexion with tonsillectomy.

Anatomical and Pathological States.—The presence of large grape-like masses of adenoids which tempt the operator to strip laterally and caudally, and further tend to encourage widespread meddlesome curettage.

Anæsthetic Complications.—Providing the head is hanging well back, we prefer deep surgical anæsthesia, as without the latter the surgeon must necessarily be

hurried, and may easily denude the lower part of the pharynx and the soft palate of its epithelium. This leads to *atresia palati* (as in Case III, *vide infra*).

The theory that a lightly anæsthetized patient with the cough reflex present cannot inhale mucus or blood is, to our minds, definitely fallacious. Laboured breathing, which almost invariably occurs in the analgesic and excitement stages, necessarily involves full abduction of the vocal cords with each inspiration. Foreign material such as firm blood clot, tooth fragment or piece of adenoid tissue may literally be sucked into the larynx and pass between the widely divergent cords during such an inspiration, the whole process occurring with such rapidity that a cough reflex is not initiated, or else is aborted.

Surgical Complications and Poor Technique.—We find many operators (*a*) do not bring the cutting edge of the curette up to the naso-pharyngeal roof, and (*b*) do not allow the cutting edge of the curette to leave the dorsal naso-pharyngeal wall high enough. This results in the raw area being situated as far caudally as, or even lower than, the level of the uvula. The too low sweep of the curette still in contact with the mucous membrane must necessarily predispose to palatal adhesion to the dorsal pharyngeal wall.

It must be remembered that the main reason for removal of adenoids is to re-establish a free airway from the posterior nares through the naso-pharynx, and so to the larynx; and the too free use of the curette not only does not help in attaining our aim, but it may produce a great deal of Eustachian canal difficulty with resulting *otitis media*.

It appears unreasonable and wanting in common-sense for an operator, otherwise skilled, to persist in performing this comparatively minor operation without due regard to the important structures surrounding the site of operation.

Case Records.

We have cited above a case of minor palatal deficiency, which illustrates an all too frequent example of this condition.

The following three cases will further exemplify the points referred to above.

CASE I.—G.R., aged five years, provided an example of large tonsils in a young child with capsule adherent to posterior faucial pillars. This necessitated great care with the guillotine to avoid the partial loss of the posterior pillars. Huge masses of adenoids were present. These were curetted, and on subsequent examination it was realized that the caudal end of the area stripped was lower than usual. The tendency of the uvula and the soft palate to sag back on to this raw area was so great that it was decided to suture the upper ends of the anterior and posterior faucial pillars. This very effectively tightened the sagging palate and avoided the possibility of adhesions to the dorsal pharyngeal wall.

Fortunately this type of case is uncommon in children, but sounds a warning as to the necessity for careful observation in the immediate post-operative stage.

CASE II.—J.L., aged five years, came under observation ten months after removal of tonsils and adenoids by a competent surgeon. The history was that the child had never been free from cold since the operation, had a nasal voice, persisting free nasal discharge with frequent projectile "sneezing out" of nasal mucus in quantities up to half an ounce, especially after rest. Bilateral *otitis media* occurred within a month of operation. The patient was thin, pale, listless and devoid of the usual mental and physical outlook of the average child. On examination there was marked excoriation about the anterior nares. The nasal discharge was very free, partly mucous, partly muco-purulent in character. On oral examination the soft palate and faucial pillars were replaced by a scarred mass which had no resemblance to normal anatomical details. There was a thick point of scar, almost like cartilage, in the median plane, with contracting lines spreading cranially and laterally. There was complete absence of communication between the mouth and the naso-pharynx.

Operation, performed under endotracheally-administered ether, was a very difficult procedure. It was necessary to attempt to remodel the soft palate, and so reestablish communication with the naso-pharynx without sacrificing any of the remains of the soft palate. This was done apparently effectively, although hæmorrhage was a very marked and annoying complication. The area was left dry, but we were called within an hour to arrest hæmorrhage. Although the child was blanched, great difficulty was experienced in arresting the hæmorrhage, which appeared to arise from the dorsal pharyngeal wall. She tolerated her anæsthetic well again, however, but the necessary manipulation was not conducive to rapid healing. Convalescence was long and tedious, owing to the anæmia, and the palatal adhesions of the newly made posterior faucial pillars to the dorso-lateral pharyngeal wall recurred. Two anæsthetics were administered subsequently for short periods, but adhesions recurred in spite of looping the soft palate forward with sutures in the mid-line and laterally.

As a further endeavour a modified Brophy technique was attempted, and two rubber tubes, each threaded with silk, were inserted, one through each anterior naris. These passed round the soft palate and out through the corner of the mouth. Immobilization was effected and the tubes were kept taut by the looped silk ends being tied behind the head. There was some regurgitation of fluid through the nose during the first three weeks. The tubes were changed by traction on coarse silk through new rubber tubes, and so a continuous "splint" remained in position for sixteen weeks. The complications were marked excoriation about the anterior nares, and at the angles of the mouth, and also the tendency for the tubes to cut through the soft palate. After removal of the tubes only a small diminution of the surgically produced communication occurred; an opening 1·25 centimetres (half an inch) in diameter still persists. There is now no nasal discharge; the child has remained free from colds; but the soft palate is very ugly and irregular, and the scar is tending to contract radially as before.

CASE III.—The patient, aged five years, came under observation in July, 1930, with a letter from her medical adviser as follows:

> A.B. has been under treatment for some weeks for *otitis media* (both ears). She has improved considerably and has no discharge at present. She gives a history of earache and otorrhœa for the past ten months. She was operated on for adenoids immediately prior to the onset of symptoms, and now has a good deal of cicatricial contraction about the soft palate. The ear condition evidently is secondary to a chronic post-nasal catarrh.

The patient's mother stated definitely that the earache and the ear discharge had been present only since operation.

On examination a condition of palate similar to that in Case II was seen, there being a central firm star-shaped scar. No posterior faucial pillar outline could be determined, except where part of the left side of the adherent uvula could be made out, and there was a communication with the naso-pharynx just large enough to admit a probe point. At operation on August 15, 1930, an attempt was made to shape the posterior faucial pillars; the uvula was freed and sutured forward on to the oral surface of the soft palate anteriorly. Fluid diet and frequent mouth washes were ordered. Adhesions formed, and on September 19 anæsthetic was administered, adhesions were divided, and rubber tubes were inserted as in Case II. Various ointments were used to prevent anterior nasal excoriation, with fair result. The communication with the naso-pharynx kept well open, and the tubes were removed on November 11, after having been in position for nearly eight weeks. The communication, however, gradually narrowed, so that on December 2 only a tiny opening could be seen, the narrowing being due to contraction of the scar and the reformation of adhesions. On December 9 division of adhesions was performed under general anæsthesia; the tubes were replaced and braced back more tightly than formerly. It was found impossible to keep the right tube to the right of

the uvula, and the presence of both tubes to the left of the uvula increased the tendency for the tubes to cut into the palate. It was decided in view of the excellent size of the communicating opening to remove the left tube, and leave the right tube *in situ*. This was done on February 24, 1931, and the right tube was removed two weeks later. On April 21 the mucosa was healthy,

FIGURE I.
View of prosthetic appliance on fixed palatal splint as used in Case III.

there was no nasal discharge, and a good communication with the naso-pharynx was apparent. All went well until June 2, when she reported with a history of right earache of seven days' duration. The right ear had been discharging for three days and both drums showed small perforations. Regular ear toilet was prescribed with good results, but on October 18 she

FIGURE II.
Another view of splint shown in Figure I.

again came under observation with left earache and a red and bulging drum, which was incised. In December, 1931, she suffered from conjunctivitis, and it was noted between October and December that the communicating opening was slowly, but surely, closing.

On January 8, 1932, in view of the failure of the previous procedures, it was decided to operate and apply a fixed splint. The patient was anæsthetized, and with difficulty a catheter was passed through the nose to the oro-pharynx and anæsthesia maintained by means of Junker's apparatus (chloroform and ether). The palate was divided from the centre of the radiating

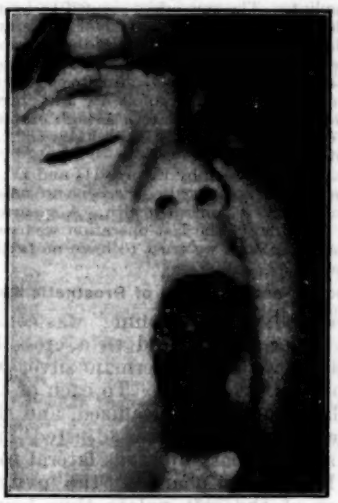

FIGURE III.
Case III, showing uvula and right faucial pillars free.

scar on the posterior pharyngeal wall right down to the most caudal limit of the old posterior faucial pillars on both sides. The bare area left on the posterior pharyngeal wall was 3·1 centimetres (an inch and a quarter) in diameter. The left palatal deficiency (due to cutting in of the tubes) was pared and sutured with silk. The dental splint, as shown in Figures I and II, was then cemented in position and the patient returned to bed.

FIGURE IV.
Case III, showing uvula and faucial pillars on both sides healed without readhesion.

The patient experienced remarkably little pain or discomfort. Strained fluids were ordered frequently; oral irrigations of acriflavine, 1 in 4,000, were administered every three hours, and alkaline nasal douches three times daily. After two weeks the palatal condition was very good, but the child had lost consider-

able weight. Eggs, milk foods, vegetable *purées* were allowed, and boiled lollies were given freely. On February 5, with chloroform mask induction and chloroform sequence through a nasal tube by means of Junker's inhaler, the splint was removed. An adhesion of the left posterior faucial pillar about its middle to the dorso-lateral pharyngeal wall was divided. (This was apparently due to the faulty position of the left vela rubber strip of the splint.) The raw edges seemed to keep well apart. The remainder of the left posterior faucial pillar and the whole of the right had healed without further adhesion. As time went on it became evident that, though the right side of the palate was satisfactory, the left side was tending to contract and adhere. Therefore, on July 1 a similar appliance was introduced after freeing the left side of the palate. A high carbohydrate diet was insisted on, and the patient did not lose weight. The splint was removed on August 12.

The result, as will be seen by Figures III and IV, is excellent; the patient's speech is normal; there is no nasal discharge, and she is in excellent general health. A recurrence of *otitis media* about the time of the last operation was very untimely, but soon cleared up, and we trust to have no further difficulty in this connexion.

Construction and Insertion of Prosthetic Appliance.

A cast coin silver "cap splint" was constructed to cover the upper teeth; and to a cross bar in the molar region two stout German silver wires were soldered, one on either side. To each of these a pad of soft Vela rubber was vulcanized, and the pads on the finished appliance were adjusted in size and direction, so as to pass upwards lateral to the uvula into the lower naso-pharynx, the uvula and the medial part of the soft palate thus being allowed free movement. The teeth were dried with acetone, the throat packed with gauze, and the splint cemented into place with Ames's black copper cement.

Technique of Repair Operations.

In repair operations of this kind necessity for good intraoral lighting is absolute. Personally we use unobstructed binocular vision with Clar's frontal reflector with focused beam.

It appears essential that dissection of palatal scar and all other dealings with the palate and its adhesions shall be by sharp, not blunt, dissection, as the latter increases the tendency to excess scar formatiom, and may lose some proportion of the already deficient soft palate.

The initial difficulty in cases of complete adhesion of the palate to the dorso-lateral pharyngeal wall consists in defining a line of cleavage in such a position as to give the maximum amount of soft palate for the remodelling process. This was evidenced in both cases II and III, where the difficulty was further increased by hæmorrhage.

The central radiating scar is almost cartilaginous in its texture, and is an unwelcome sign, as it usually foretells a narrowing of the opening into the naso-pharynx by contracting and further approximating the caudal limits of the posterior faucial pillars. This scar determines the technique in working caudally in the mid-line. The Vela rubber limbs of the fixed splint are so arranged as to exaggerate the lateral separation of the posterior pillars without involving them in such tension as may produce death of tissue and ulceration, as occurred with the use of tubes in Case III.

The various methods employed singly or together in the operative treatment of this condition are:

1. Simple division of adhesions of the palate from the dorso-lateral pharyngeal wall.

2. Occasionally it is found that a simple looping forward of the soft palate with silk, silkworm gut or chromicized catgut (after division of adhesions) causes the posterior faucial pillars to remain in the forward position for some days—long enough to prevent readhesion.

3. The insertion of tubes from the nose to the mouth as performed in Cases II and III may give successes after careful division of adhesions.

4. The Brophy technique of division of adhesions and keeping the raw surfaces separated by means of a rubber plate entails fixation very similar to that in 3, and though more promising of success, yet it exhibits the following common objections: (*a*) Difficulty in swallowing, not readily overcome. (*b*) The presence of such foreign body as a rubber tube in the whole length of the nasal airway causes difficulties in nasal breathing and rhinitis, with profuse mucopurulent discharge, resulting in excoriation about the anterior nares. (*c*) Nasal voice and general disability in speech. (*d*) Tendency to pansinusitis, and to a lesser degree *otitis media*. (*e*) The cutting into the newly separated palate owing to the tension, which is essential, if the method is to be effective. (*f*) The psychological aspect, which is very important. The unsightly nasal tubes appear in some degree to bring about an inferiority complex, akin to that exhibited by patients with harelip and cleft palate.

5. The use of a prosthetic appliance (or fixed palatal splint) as described above, seems to hold distinct advantages over the previous methods. The division of adhesions and the insertion of a splint offer better separation of the surfaces than other methods, and are free from many of the objections which cause failure in methods 3 and 4. For example, dysphagia does not seem as gross; no difficulty is experienced in nasal breathing; no gross rhinitis supervenes, and excoriation about the lips and anterior nares is absent. Further, there is no gross tendency to pansinusitis and no cutting into the palate has been observed. Speech is practically normal.

Conclusion.

It is felt that the improvement in treatment as indicated in method 5 constitutes a definite advance, and even though it necessitates a general anæsthetic to remove the palatal splint, the advantages in better separation of the raw surfaces, and the absence of complicating symptoms, far outweigh any other objections.

Acknowledgements.

We desire to thank Dr. J. Saleeba for much help in the care of the patient in Case III, and Dr. J. M. Lewis for the photographs illustrating the same case.

Reports of Cases.

ABSENT TENDON REFLEXES AND TONIC PUPILS.

By MICHAEL SCHNEIDER, M.B., B.S. (Adelaide),
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Clinical History.

IN May, 1932, E.C.W., a female, aged thirty-six years, complained of blurring of the vision when reading. It had

developed suddenly three weeks previously. Examination revealed the following: The vision of the right eye was $^6/_{12}$. With a convex spherical lens of 1·25 diopters and a cylindrical lens of 0·25 diopter with its axis at 120°, the vision was $^6/_{7·5}$. The patient could read Jaeger type 6.

The vision of the left eye was $^6/_{7·5}$. With a convex spherical lens of 1·25 diopters and a cylindrical lens of 0·25 diopter with its axis at 60°, the vision was $^6/_6$. The patient could read Jaeger type 1.

The right eye showed the following changes: There was slight ptosis of the upper lid. The pupil was semi-dilated, and about five millimetres in diameter. It reacted to light and accommodation, but not as actively, nor did it ever become as small as the left pupil. In the dark room it dilated well, and the pupils of the two eyes became equal in size. There was no alteration in its behaviour to mydriatics or myotics, and cocaine instillations diminished the amount of ptosis.

The knee jerks were present; the ankle jerks were not investigated.

The patient was given drops of pilocarpine nitrate, 0·25%, to be used for the right eye when necessary, and she found that she was able to read and sew for about an hour after instillation of these drops.

The patient was seen again about four months later. Her symptoms were more pronounced and gave her much discomfort when reading unless she closed the right eye. The right pupil was now about seven millimetres in diameter, and completely inactive to light and shade. After fixation on a near object for about thirty seconds it contracted to about six millimetres in diameter, and after relaxation returned slowly to its original size.

The knee jerks and ankle jerks were absent on both sides, and the blood gave no reaction to the Wassermann test.

Comment.

This case belongs to the group of diseases recently described by Adie under the name of "tonic pupils and absent tendon reflexes." Adie in his paper concludes that many of the cases described by writers since 1902, under such names as the following, belong to this group: pupillotonia, myotonic reaction, tonic convergence reaction of pupil apparently inactive to light, Marcus's peculiar pupil phenomenon, non-luetic Argyll-Robertson pupil, pseudo-Argyll-Robertson pupil, as well as those of fixed pupil, *ophthalmoplegia interna*, *iridoplegia interna*, and iridoplegia of unknown origin. Adie has carefully examined and tabulated the findings in these cases which amount to about 100 in all, and concludes that he is dealing with a disease *sui generis*. He divides the cases into complete and incomplete forms. In the complete form one or both pupils are inactive to light, but react to convergence, and there is absence of diminution of one or more tendon reflexes. The incomplete forms may be grouped into four varieties: (i) tonic pupils alone, (ii) atypical phases of the tonic pupils alone, (iii) atypical phases of the tonic pupils with absence of tendon reflexes, (iv) absent tendon reflexes alone.

Ætiology. The ætiology is quite unknown. The condition is certainly not due to syphilis. Its symptoms suggest a disorder of the vegetative nervous system. Eighty *per centum* of the patients were females, and in 80% the condition was uniocular.

Symptoms. There may be no subjective symptoms whatever, the condition being found during routine examination of the eyes. Other patients complain of a feeling of discomfort in the eye. The vision may be blurred; in these circumstances the onset as a rule has been sudden, and one finds a dilated pupil. There may be an accompanying slight ptosis.

Signs. In most cases the affected pupil is larger than its fellow. It commonly changes its size from time to time. The reaction to light is completely or almost completely absent. In the dark room the pupils usually dilate to an equal size after the lapse of an hour or so, and then when exposed to diffuse light the abnormal pupil contracts slowly, and may continue to contract until it is smaller than it was before it dilated in the dark room. After a time it again dilates to its original size.

During accommodation the pupil contracts slowly (often after some delay) through a range which may be much greater than the normal. When convergence is relaxed the pupil (*a*) may continue to contract, (*b*) may remain unaltered for some time, (*c*) may dilate slowly at once. Accommodation may be interfered with during relaxation. In other words, after fixing on a near object, several seconds elapse before objects become clear.

The reaction to mydriatics and myotics is not interfered with.

One or both ankle jerks or knee jerks may be absent.

The Wassermann test gives no reaction.

Differential Diagnosis. Paralytic lesion of the third nerve which may give internal ophthalmoplegia, external ophthalmoplegia, or both groups of orbital muscles may be paralysed.

The differences between Argyll-Robertson pupil and tonic pupil may be set out as follows:

Argyll-Robertson Pupil.	*Tonic Pupil.*
Small.	Larger than its fellow.
Bilateral usually.	Unilateral.
Size is constant.	Size varies over different periods.
Unaltered by light or dark.	Dilates slowly in dark room.
Contracts rapidly on convergence.	Contracts after a delay on convergence.
Dilates rapidly when convergence ceases.	Dilates slowly, and after a delay.
Dilates poorly with mydriatics.	Dilates well with mydriatics.
Wassermann reaction positive.	Wassermann reaction absent.

In diphtheria there may be loss of tendon reflexes and ocular symptoms which appear about ten weeks after the onset, and then disappear four to eight weeks later. The pupil, however, is inactive to light and convergence; accommodation is paralysed, and it is usually bilateral.

In *encephalitis lethargica* tonic pupils are never encountered.

Course. As far as these cases have been observed the disease is benign, and does not interfere with the duration of life.

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W. J. Adie: "Complete and Incomplete Forms of the Benign Disorder Characterised by Tonic Pupils and Absent Tendon Reflexes", *British Journal of Ophthalmology*, Volume XVI, 1932, page 449.

Reviews.

STATISTICS AND RESEARCH.

THE new edition of R. A. Fisher's "Statistical Methods for Research Workers"[1] is a revision and an enlargement of the third edition, but does not differ from the latter in any material respect. It is addressed to those biological workers who are concerned with the practical tests that may be applied to the results of experimental work, rather than with the underlying statistical theory.

The formulæ appropriate to the analyses of the various types of data are clearly stated, and the applications of the formulæ are illustrated by numerous worked examples. There is little in the way of practical tests that is not considered, and within the compass of some three hundred pages the author covers a great deal of ground. The provision of extensive statistical tables is a noteworthy feature of the book and, on the whole, the demands of the biological worker have been adequately satisfied.

[1] "Statistical Methods for Research Workers", by R. A. Fisher, Sc.D., F.R.S.: Fourth Edition; 1932. Edinburgh: Oliver and Boyd. Demy 8vo., pp. 320. Price: 15s. net.

The book will repay careful reading and can be recommended to those who, despite their limited mathematical equipment, are nevertheless concerned with the degree of reliance that may be placed on their results. The usefulness of the book, however, to those who possess more than an elementary knowledge of mathematics would have been materially extended had the author included proofs of the more important statistical formulæ.

GONORRHŒA.

PELOUZE'S "Gonorrhea in the Male and Female", second edition, is a work in which the author, encouraged by the success of the first edition, presents a short commonsense interpretation of the disease in both sexes.[1]

The volume is well written in a series of short chapters designed, not as a text book, but to give the practitioner a better understanding of the subject, as well as a rational basis for the treatment of the disease. There is a constant plea throughout for the avoidance of trauma in the management of gonococcal urethritis, both on the part of the practitioner and of the patient, whereby many of the complications are prevented. There are some additional chapters in the second edition, and of particular interest are those dealing with arthritis and gonococcal ophthalmia.

Part three deals with the subject of gonorrhœa in the female. The author advocates the need for a closer study of the definitely non-surgical fields, to the end that the surgical fields be avoided. This section is primarily a careful study of the disease in both sexes, revealing the fact of the countless analogies between them. Here again the author lays great stress on the avoidance of trauma, particularly in the treatment of the disease by the use of strong antiseptic solutions in its early stages. Of special interest are his remarks with regard to treatment during the menstrual period, as also is his description of the taking of specimens for microscopic examination.

He does not appear to place much reliance on the complement fixation test, whereas other workers with experience of this test regard it of paramount importance in diagnosis and as a criterion of cure, particularly in the female.

By reading this volume, one cannot fail to gain much knowledge of the subject, and it deserves a prominent place in the libraries of those practitioners who associate themselves with the treatment of gonorrhœa.

SCIENCE AND LIFE.

SCIENTISTS who have the gift of making science interesting to those not scientifically trained are few in number. J. B. S. Haldane, Sir William Dunn Reader in Biochemistry in the University of Cambridge, has this gift. "Possible Worlds", his book of essays published in 1927, achieved a great success. "Possible Worlds" has now been followed by "The Inequality of Man and Other Essays".[2] The book is a collection of essays and addresses, as the author states in his preface, a rather mixed bag of writings, attempting to show "how science affects human life".

Scientific methods can explain some of the phenomena of life; they cannot explain its hidden meaning, and never will be able to explain it. The author in this book is more philosophical in the treatment of his subjects than he was in "Possible Worlds". At the same time he is never profound. Instead he is superficially clever; by a smart simile or an absurd comparison he makes his point, and the non-philosophical are both instructed and satisfied. The author rather disarms criticism by stating in his preface that he hopes to please a variety of tastes, that the essays do not form a wholly coherent logical system, and that he has been far too busy to evolve a complete philosophy of life. It must not be understood from this that these essays are without interest. On the contrary they hold the interest from first to last, or, shall we say, last but one.

The first essay, "The Scientific Point of View", is excellent. We should like to see it broadcasted. "Science can do something far bigger for the human mind than the substitution of one set of beliefs for another, or the inculcation of scepticism regarding accepted opinions. It can gradually spread among humanity as a whole the point of view that prevails among research workers." In the absence of the scientific point of view human effort is largely devoted to conflicts with fellow men. "It is only in times of disaster that the average man devotes a moment's thought to his real enemies, 'the rulers of the darkness of this world,' from bacteria to cyclones. Until humanity adopts the scientific point of view these enemies will not be conquered." The author discusses some of the taboos surrounding the teaching of biology. "Human physiology is indecent." He points out that even the most conservative must regard a biological attitude to the physiology of reproduction as preferable to the hedonistic attitude adopted at the present time by many of the rising generation.

The second essay deals with the inequality of man, a truth which is apt to be forgotten by some of the followers of socialism. "Human inequality springs from two sources, nature and nurture." Haldane shows that men cannot be equal, and he states that the progress of biology in the next century will lead to a recognition of man's innate inequality. This, he adds, is today most obviously visible in the United States, where educational opportunities are more widespread than elsewhere. Universal education leads, not to equality, but to inequality based on real differences of talent. He then discusses psychological tests for estimating innate ability. Professor Spearman has said that every person is a genius at something. The scientific State, Haldane holds, would make it its first business to investigate this problem. He concludes this essay by stating that today the recognition of innate inequality should lead not to less, but to greater equality of opportunity.

The essay on "Scientific Calvinism" ends with a plea for the adoption of a scientific attitude regarding crime. In "Possibilities of Human Evolution" Haldane writes of Bernard Shaw and Stapledon as prophets, and refers to "Back to Methuselah" and "Last Men and First Men". Speculations such as are set out in these two books are to him desirable, because they focus attention on the need for knowledge before means can be suggested of attaining the goal of human evolution. Among the other essays are: "Is History a Fraud?" "Science and Ethics", "Man's Destiny", "Some Consequences of Materialism", "God-Makers", "Birth Control", "The Story of My Health", "If Jesus Lived Today", each of which is handled in characteristic and sometimes brilliant, if superficial, fashion. Haldane makes too many references to his own agnosticism, and more than once refers to himself as an intellectual. But in these moments the reader can smile, even as he smiles at the sharp sallies produced by the agnostic's intellectuality. Perhaps the author unconsciously speaks the truth on page 131: "Nevertheless, as an intellectual curiosity I put that point of view before you." Whether he is, readers must judge; we prefer not to contradict him.

Mention has been made of the last essay but one, "The Gold-Makers". We wonder why this story (it is not an essay) was included. It is a tale of some French folk with one of whom Haldane is supposed to have come into contact. They recovered gold from sea water and were making their fortunes when some ruffians tracked them down and murdered them. Haldane is supposed to have been hunted round France by the murderers. The tale is out of place in this book. Perhaps the book looked too small and Haldane included the tale to fill up space.

In spite of "The Gold-Makers", we strongly advise our readers to buy this book.

[1] "Gonorrhea in the Male and Female: A Book for Practitioners," by P. S. Pelouze, M.D. Second Edition; 1932. Philadelphia and London: W. B. Saunders Company; Melbourne, Brisbane and Christchurch: James Little and Son. Royal 8vo., pp. 440, with illustrations. Price: 36s. net.

[2] "The Inequality of Man and Other Essays", by J. B. S. Haldane, F.R.S.; 1932. London: Chatto and Windus; Australia: Angus and Robertson, Limited. Demy 8vo., pp. 302. Price: 11s. 3d. net.

The Medical Journal of Australia

SATURDAY, FEBRUARY 4, 1933.

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PUERPERAL SEPSIS.

DURING the last few months reference has been made on two occasions to the final report of the Departmental Committee in Great Britain on maternal mortality and morbidity. On the first occasion the general scope of the inquiry and the main conclusions were stated. On the second the subject of maternal care, particularly before delivery, was discussed. Another aspect of the report, and in some respects the most important, is that of puerperal sepsis. Readers will remember that in recent years there has been much argument about endogenous and exogenous sources of puerperal infection. The known facts have been stated over and over again in this and other medical journals, but the statement of the Departmental Committee is so clear and the teaching is so valuable that this part of the report cannot be neglected.

The first fact emphasized is that it was shown in the *interim* report that 40% of the deaths found to be due to septic infection followed normal labour; in the later series the proportion was 50%. Fatal septic infections following normal labour constitute 18% of all the deaths attributed directly to child-bearing. The important point is that many of these deaths are preventible. Bacteriological investigations have made it clear that the majority of the deaths from infection following normal labour (85%) are caused by the hæmolytic streptococcus, *Streptococcus pyogenes*. In discussing the distribution of infections by this organism the Committee shows that there is no truth in the widely-held view that infection following child-birth occurs much more frequently in maternity institutions than in the patients' own homes. In some centres in which bacteriological examinations were made, it was found that the incidence among women delivered at home was more than double that found among women delivered in hospital. In view of the preference shown by many Australian women and by some medical practitioners for the conduct of delivery in the private home, and in view of the increased provision that is being made for midwifery beds in Australian public hospitals, this observation needs to be made widely known in Australia. The Committee quotes figures to show that normal midwifery is being carried on "with an extremely small expectation of serious sepsis", but adds that clearly midwifery is not always carried out in this way. The same statement would be true of Australian midwifery.

Under the heading of sources of infection three agents are discussed: the *Streptococcus pyogenes*, anaerobic streptococci, and the *Bacillus coli*. Since the aerobic *Streptococcus pyogenes* is responsible for most of the serious infection, and since prevention can do a great deal to lessen this type of infection, attention will be confined to this organism. Authorities are quoted to show that the majority of puerperal infections are unlikely to be due to streptococci native to the patient's body. This must be regarded as proven. Several carefully made bacteriological investigations have shown, moreover, that pathogenic streptococci are often transferred from the throat or nose of someone in attendance on the patient to the parturient genital tract. Examples of this transfer have been reported in this journal. Transfer may occur from droplet spray on to the vulva and vestibule, but probably

is more often effected indirectly by the attendant's hands, by instruments or by dressings. It is not unlikely that in a few instances the infecting streptococci are conveyed by the mother's fingers from her throat or nose to the vulva. In discussing prevention the Committee points out that the obstetric toilet in common use breaks down from time to time because it does not take into account the possible danger from throat-carried streptococci and droplet spray. Obviously the wearing of masks by all in attendance on the patient should be obligatory. The Committee states that there is no adequate reason why a practice which has long been adopted in operative surgery should not be brought into general use in obstetric work; the members of the Committee think that public opinion "will in a very short time demand this elementary safeguard". The conclusion may be stated in more general terms that the technique of the labour room should be that of the operating theatre. A delivery, whether any abnormal factors are present or not, must be treated with the same attention to aseptic detail as is necessary to the performance of an abdominal section. We would add to this our conviction that all obstetric infections should be investigated by a bacteriologist and that the investigation should include examination of the noses, throats and fingers of both medical attendant and nurse.

Current Comment.

THE TREATMENT OF ACUTE CORONARY THROMBOSIS.

PERHAPS some of the students of medical literature are almost tired of reading about coronary occlusion, and the refinements of electrocardiographic study, for example, may be left to those specially interested. But no practitioner of medicine can afford to be ignorant on a topic of such signal importance as the treatment of acute coronary thrombosis. In an article on the subject Samuel A. Levine remarks that he seldom sees patients in the earliest stages of this emergent state.[1] As Levine is a well known authority, this statement is significant, though, of course, it must be obvious that first aid and the early hours of care must be given by the general practitioner. Even the surgeon cannot neglect this dramatic condition, for the severe pain is frequently epigastric, simulating that of a surgical emergency.

It is, of course, most necessary that an accurate idea of the anatomical and pathological conditions involved should be clearly understood. The most elementary fact is the most important. Once it is realized that the heart is the site of the trouble, it will be evident that it must be spared every ounce of energy. Levine's advice should be followed in the early hours following the onset of symptoms. The patient should not be moved from place to place unnecessarily; he should even be not undressed if at all severely ill, nor should he be subjected to needless examinations. This must be stressed. Soon after so serious an accident no risk should be taken; the management of the first day or two may determine the patient's recovery. The relief of pain is of paramount importance. Morphine should be given at once, never less than 0·015 gramme or a quarter of a grain, and repeated after thirty or even fifteen minutes if required, until even 0·06 gramme or one grain has been given within a couple of hours or less. When pain has been relieved other sedatives may be used to induce sleep. Vasodilators should not be given. This advice is important, as certain of these patients are accustomed to carry tablets of vasodilator drugs with them for use in emergencies, and their use is to be discouraged in these cases. Levine considers that the emergency use of epinephrine is reasonable if the patient is collapsed and unconscious. This is worth remembering, for there are cases in which the patient is found unconscious and the nature of his malady is unknown at first. The use of some adrenal preparation then can do no harm and may do good. Shock requires the usual treatment, and warmth is essential as an adjuvant to efficient and easy circulation. When the patient is able to swallow, fluids should be given freely, for there is usually a copious sweating, and fluids may then be pushed till oliguria has disappeared. The use of dextrose is logical, and it has even been used intravenously with success, 50 to 100 cubic centimetres of a 50% solution being slowly run into a vein. The heart must have an adequate supply of sugar. These patients are sometimes sufferers from diabetes, but apart from these glycosuria is not an uncommon finding after a coronary thrombosis. Here care must be taken. The medical attendant must not jump to the conclusion that insulin is indicated, for it is more often contra-indicated. It should never be employed in the acute stage. As Levine points out, even after an average dose of insulin the work of the heart may be increased over 25%. Stimulants of other kinds may be employed, such as caffeine sodio-benzoate, though their action is not certain. Sometimes they appear to do good. Oxygen may be very useful when the patient exhibits dyspnœa or air hunger. But in many cases there are only two things really necessary: absolute rest and morphine. Where the patient is known to suffer from syphilis of the

[1] *The Journal of the American Medical Association*, November 19, 1932.

circulatory system, this knowledge should be disregarded for at least a week, and then the administration of iodides may be begun. Intravenous medication should be very cautiously employed later, if at all.

Of the complications Levine specially mentions heart block and paroxysmal ventricular tachycardia (which is not grossly irregular like an auricular fibrillation, nor quite regular like auricular tachycardia). For the latter he uses quinidine, with caution, for he remarks that in animals fibrillation of the ventricles occurs much less readily after the administration of quinidine.

Finally, a most important point, how long is the patient to stay in bed? This, of course, depends upon the severity of the attack, as measured by the intensity of initial symptoms, their persistence, febrile reaction *et cetera*. But Levine advises a bed rest of from five to six weeks in all cases. All physicians must have seen patients who have made excellent recoveries after a much less extensive rest than this. But nevertheless the advice is sound. It is very difficult to say just how seriously the heart is damaged or just how extensively the coronary vessels are diseased. The patient often feels very well after a few days, and no doubt will argue with his medical adviser, but if the latter knows just how to treat this serious emergency in its earliest hours and thereafter how to conduct its safe management, his patient should be strongly urged to obey.

GLOSSOPHARYNGEAL NEURALGIA.

THE ninth cranial nerve has been somewhat neglected by clinicians. The existence of trigeminal neuralgia is so well known that it is rather surprising that more recognition has not been given to a cognate condition occurring in another cranial nerve field. As has happened with a number of other neurological morbid conditions, interest has been aroused or revived in part at least by surgeons. The subject has been dealt with recently by Leonard A. Ball,[1] who describes this variety of neuralgia and gives a case history, with account of an extracranial operation for its relief.

W. S. Keith, in an article of recent date, reports seventeen cases and discusses the treatment.[2] Keith remarks that even in 1926 Dana said that the ninth cranial nerve, suffering "no tic, palsy or algia . . . receives only disregard and aloofness from surgeons and clinicians", in spite of the fact that Sicard and Robineau had reported two cases of glossopharyngeal neuralgia six years before. Many reports have accumulated since; Dandy contributed twenty to the literature.

Keith's review of his own and other cases supplies a useful symptomatology. The patients are usually over forty years of age. The pain is paroxysmal, and there may be remissions for considerable periods, in one case as long as eight years. It is invariably induced by some movement of the tongue or pharynx, such as swallowing, and its site is in the distribution of the nerve. As there has been some difference of opinion as regards this distribution, the clinical findings are of interest. Keith points out that Dandy asserts that there is no external sensory supply by the ninth nerve, but Ramsay Hunt produced evidence of supply to part of the posterior portion of the tympanum, the auditory canal, concha, auricle and adjoining mastoid region through a twig to the auricular branch of the vagus. It is noteworthy that *herpes zoster* has occurred in these regions in association with ninth nerve neuralgia. Of course, overflow into other innervations, for example, the territory of certain cervical nerves, may occur when the pain is severe and of long standing. All this is of practical interest because reference of the pain to the ear is common, and misleading, unless the cause is realized. The pain usually starts in the throat, in the tonsillar region, or at the base of the tongue. It is unilateral, except where due to some extraneous cause, such as neoplasm. As the part affected is relatively deep, and localization relatively imperfect, the patient often has difficulty in describing the exact site of the trouble. But the place and nature should be distinctive. Of course, it is most essential to exclude associated disease, such as intracranial tumour or carotid aneurysm, or carcinoma of the tonsil or larynx. In passing, it may be remarked that neuralgia in this region, sometimes with a more or less faithful glossopharyngeal distribution, is not very uncommon in tuberculous laryngitis involving the epiglottis. This brings us to the question of "trigger" spots whose importance is emphasized by Keith. These often correspond to the areas of most intense pain and may be discovered by examination.

Before treatment is instituted it is obvious that correct diagnosis is imperative. Keith records cases in which futile operations on the fifth nerve have been performed. Drugs will sometimes give sufficient relief and perhaps the raising of this particular pain threshold may favour the advent of a remission. But, failing this, alcohol injection may be made into the nerve, or extracranial section or evulsion may be performed, the end of the nerve being buried in fascia or muscle. This avoids the risk of intracranial operation. Should the latter be necessary, it is, of course, work for an expert. Adson, Dandy and others have contributed to our knowledge of the operation of intracranial section of the nerve. This will not concern any but the neuro-surgeon. But the practitioner who meets with a paroxysmal unilateral neuralgia in this characteristic site should recognize it, and as (except for drugs) its treatment is so different from that of trigeminal neuralgia, he should not class it as such, though there is no reason why he should not extend the scope of the vague term *tic douloureux* to include the ninth nerve neuralgia.

[1] *Australian and New Zealand Journal of Surgery*, July, 1932.
[2] *Brain*, September, 1932.

Abstracts from Current Medical Literature.

PHYSIOLOGY.

The Thymus and Reproduction.

DOROTHY H. ANDERSON (*Physiological Reviews*, January, 1932) has reviewed experimental investigations into the relationship between the thymus and reproduction. She comes to the following conclusions. The thymus gland increases in size until about the time of puberty, when it undergoes involution. The microscopic picture is typical in the various age periods. During involution there is decrease in cortex, and to a less extent of the medulla, with replacement by connective tissue and fat. The normal age involution is probably hastened by mating, pregnancy and lactation. There may be regeneration after pregnancy. Castration or spaying of young animals delays, but does not prevent, age involution. No effect on the morphology or physiology of reproduction, except through trauma or infection from the operation, has so far been demonstrated after thymectomy. The administration of thymus gland has no specific effect on reproduction, other than that of a good food. So far no specific effect on reproduction has been demonstrated after the administration of thymus extract. The transplantation of adult gonads into young animals probably hastens age involution. The injection of adult blood serum into young animals may hasten age involution.

Muscular Fatigue and Resistance.

THE view is commonly held that muscular fatigue lowers resistance and is a predisposing factor to infective diseases, especially respiratory infections. Anna M. Baetjer (*Physiological Reviews*, July, 1932) reviews the experimental work which has been done to test this view. She points out that the results of experiment have been varying and indecisive, and therefore concludes that muscular fatigue does not exert a dominating influence upon the activities of the defence mechanisms of the body. Its influence must be of a minor character, which can be revealed satisfactorily only by controlling the variable conditions that enter into experimental work.

Ovulation in the Rabbit.

EDUARDO BUNSTER (*Bulletin of the Johns Hopkins Hospital*, November, 1932) has tried to detect the presence of a gonad-stimulating hormone in the blood of the pregnant doe by means of small and large blood transfusions from the pregnant to the normal adult animal. He points out that in this way the possible action of the kidney is eliminated. After isolation for a period of a month and upwards, adult female rabbits were transfused with 10·0 to 62·5 cubic centimetres of blood. In spite of the fact that the amount of blood injected represented in two instances 38·8% and 39·9%, respectively, of the total amount of blood calculated as existent in the pregnant donors, ovulation did not occur. This finding was determined by laparotomy eighteen hours after the transfusion.

An Anti-Growth Factor Derived from the Parathyreoid Gland.

M. H. B. ROBINSON AND J. H. THOMPSON (*Journal of Physiology*, November, 1932) report the preparation of extracts of parathyreoid glands, free from the principle affecting calcium metabolism, but which cause retardation of growth when injected subcutaneously in various animals. Acid alcohol extracts of the gland form the basis of a number of different preparations differing in activity. The tests have chiefly been carried out on rabbits and rats. No toxic effects have been observed. Indeed, the authors claim that the injected animals are less subject to intercurrent disease than the controls. Daily injections have been given for many months without any evidence of disturbance of calcium metabolism, and at the end of the experimental period there is no sign of decalcifying of the skeleton, though all the bones are smaller than in the control animals. A tolerance is acquired to certain extracts, while other extracts cause a persistent inhibition of growth for at least two months after the injections have ceased. The active principle withstands autoclaving at fifteen pounds pressure for several hours, but slowly loses its potency at room temperature or even when kept in a refrigerator. Treatment of active extracts with hydrogen peroxide rapidly destroys all the growth inhibiting principle.

The Diuretic Action of Alcohol.

MARGARET M. MURRAY (*Journal of Physiology*, November, 1932) has attempted to determine the mechanism of the diuresis produced by the oral administration of alcohol by noting the effect of pituitrin on the diuresis. In fasting human subjects the ingestion of 300 cubic centimetres of 10% alcohol was able to counteract in part the antidiuretic action of 0·1 unit of pituitrin injected subcutaneously. Analyses of the urine during the diuresis due to alcohol showed that the concentration varied inversely as the volume, suggesting that an exaggerated water diuresis is produced. Attempts to determine the degree of hydræmia by estimations of the osmotic pressure of the blood did not prove successful. In animals anæsthetized with "Amytal" water diuresis is produced only with difficulty when either water or alcohol is given, but the subsequent injection of pituitrin causes some diuresis. The administration of pituitrin after the ingestion of dilute alcohol leads to a slight increase in the output of urine. The diuresis is, however, only about one-third as great as when the alcohol is replaced by water. Since alcohol antagonizes both the diuretic and antidiuretic actions of pituitrin and has been found to inhibit pituitrin hyperglycæmia, a general antagonism between these two principles is suggested.

BIOLOGICAL CHEMISTRY.

Afternoon Glycosuria.

V. J. HARDING, D. L. SELBY AND A. R. ARMSTRONG (*Biochemical Journal*, Volume XXVI, Number 4, 1932) have carried out morning and afternoon glucose tolerance tests on subjects who have given a positive response to Benedict's test for urinary sugar and who presented no other sign of disability. Afternoon glycosuria was found in fourteen subjects out of twenty-eight. All the subjects with afternoon glycosuria showed a higher blood sugar peak in the afternoon, and some showed high peak blood sugar curves, but failed to manifest glycosuria. In some the difference between the morning and afternoon blood sugar peaks was small. In twenty-one, however, the difference was ten milligrammes or more. One subject, showing almost identical morning and afternoon glucose tolerance curves, had definite afternoon glycosuria. These workers assume that alterations in the renal threshold occur during the day in some subjects, and they believe that a possibility of a diurnal change of this character complicates enormously the explanation of the physiological glycosuria.

A Dietary Principle Stimulating General Growth and Lactation.

L. W. MAPSON (*Biochemical Journal*, Volume XXVI, Number 4, 1932) has recorded results indicating the presence in liver of a substance capable of considerably augmenting the growth of rats maintained on a diet containing all the hitherto known dietary principles in amount approximately twice the normal. The growth curves and the general condition and characteristics of the animals which have received such a stimulus to growth indicate, this writer believes, that he is dealing with normal physiological processes which have been stimulated to an increased activity, and he brings forward the hypothesis that it is due to some stimulation of endocrine function. The substance has been shown to have a much more marked effect on the growth rate of the male than the female, and the stimulating effect on the growth rate after weaning is transmitted from a parent which has received the active substance in its diet, to its offspring fed solely on the synthetic diet. This growth-promoting substance has been shown to be distinct from hitherto known accessory food factors, and preliminary investigations into the nature of the active substance are reported in this paper. Liver has also been shown to have a stimulating

effect on lactation, and the average number of young born to parents fed on liver was definitely greater than the average number in control litters. The author tentatively suggests the name physin for the growth-promoting substance and has not yet determined whether the substances stimulating growth and lactation are the same.

Diabetes Without Glycosuria.

I. M. RABINOWITCH (*Biochemical Journal*, Volume XXVI, Number 4, 1932) has made fifty-eight analyses in nineteen cases to determine whether the hyperglycæmia in diabetics with raised renal threshold is due to true blood sugar or to other reducing substances. Blood sugar estimations were made before and after fermentation. Little, if any, relationship between the degree of hyperglycæmia and the amount of non-fermentable reducing substances was found, though the amount of non-fermentable reducing substance was found with the most marked degree of hyperglycæmia. In one patient there was a fermentable blood sugar value of 0·764% without glycosuria. The author concludes that the raised renal threshold in diabetics is real and not apparent; that the hyperglycæmia in these cases is due chiefly to fermentable sugar and not to other reducing substances which are ordinarily found in blood. He also thinks that in view of the possible finding of as much as 60 milligrammes of non-fermentable sugar per 100 cubic centimetres of blood, and in view of the alleged unfavourable prognosis with raised renal threshold, a diagnosis of this condition should not be made without the determination of the relative proportions of fermentable and non-fermentable reducing substances. No relationship was found by him between the amount of non-fermentable reducing substance in the blood and albuminuria.

Parathormone Action.

J. P. MCGOWAN (*Biochemical Journal*, Volume XXVI, Number 4, 1932) has undertaken a series of experiments to determine the mode of action of parathormone and also as to whether vitamin *D* acts primarily and solely through the intermediation of the parathyroid gland. Because of an acquired familiarity with the histology of their organs, laying hens were used throughout the experiments. Parathormone in large doses was given intramuscularly every day, on account of the insusceptibility of the birds. The calcium content of the blood serum and the phosphorus content of the whole blood were determined from time to time, while at the death of the fowls sections were prepared from practically every organ and tissue of the body and treated by von Kossa's silver nitrate method for the determination of tricalcium phosphate. The intramuscular injection of parathormone into hens has produced as the main result a deposition of tricalcium phosphate inside the vessel. The author believes that this is in all probability brought about by the parathormone liberating calcium hydrogen phosphate from the bones by a direct stimulation of the activity of the osteoclasts. From the results of this investigation the author believes that vitamin *D* functions in two ways, primarily by liberating phosphoric acid in the tissues, which attracts calcium from the intestine or bones by its acidity, and, secondarily, by invoking the aid of the parathyreoids through an induced hypocalcæmia.

The Action of Copper in Iron Metabolism.

C. A. ELVEHJEM AND W. C. SHERMAN (*Journal of Biological Chemistry*, October, 1932) have presented the results obtained in a series of experiments in which special emphasis was placed on the action of copper on the storage and utilization of iron in the animal body. The addition of pure iron to the milk diet of anæmic rats which had been well depleted in their reserve of iron, was found to have no effect on the hæmoglobin content of the blood, but to increase to a large extent the total iron content of the liver and spleen. When the iron was replaced by copper, the store of iron in the liver was found to be used directly for building blood hæmoglobin. The copper caused only a slight decrease in the iron content of the spleen, but produced a definite increase in the size of this organ. Inorganic iron was found to be much more readily assimilated and stored in the liver than organic iron, as the livers from those animals receiving ferric chloride contained five times as much iron as those from rats given hæmatin. When graded levels of inorganic iron were fed in the absence of copper, the hæmoglobin content of the blood remained unchanged and the amount of iron stored in the liver was proportional to the amount of iron fed. In the presence of copper the rate of hæmoglobin formation was dependent upon the iron intake, and the liver showed no iron storage until 0·3 milligramme or more of iron was fed. The authors conclude that copper does not affect the assimilation of iron, but does function in the conversion of inorganic iron into hæmoglobin.

The Protein Component of the Erythrocyte Membrane or Stroma.

ERIK JORPES (*The Biochemical Journal*, Volume XXVI, Number 5, 1932) has studied the protein of the erythrocyte membrane or stroma by isolating the membranes from horse and sheep blood. After hæmolysis with distilled water, the "ghosts" were flocculated by adjusting the reaction with hydrochloric acid to a pH value of about 5·5. They were washed relatively free from hæmoglobin with distilled water and a slightly acid dilute phosphate solution. The membrane preparations finally contained 14% to 30% hæmoglobin, according to the iron analyses. The stroma protein was found to have a characteristic composition differing from the other blood proteins, and its physical properties were also found to be characteristic. Its low nitrogen content and nitrogen distribution, according to Van Slyke, were found to correspond to those of the acid proteins. Herein and through its content of arginine and histidine the membrane protein differed from hæmoglobin and globin. Neither did it show any resemblance to fibrin or globulin, from which it differed in its content of tyrosine and tryptophane. The author suggests the name stromatin for this membrane protein, and discusses the bearing of these findings upon the permeability of the erythrocyte membrane towards ions, and suggests that some of the immunizing properties of the red blood corpuscles are located in this protein.

The Absorption of Nitrogen and Fat.

M. M. SAMPSON, M. DENNISON AND V. KORENCHEVSKY (*Biochemical Journal*, Volume XXVI, Number 4, 1932) have investigated the factors responsible for the pathological condition leading to failure of normal growth in rats kept on a diet deficient in vitamin *A*. The body weight, appetite, intake and absorption of fat and nitrogen and the nitrogenous metabolism of two male rats kept on a diet deficient in vitamin *A* were compared with those of two control litter mates kept on a complete diet. Each control rat was paired as regards food intake and the other conditions of the experiment with a rat on a diet deficient in vitamin *A*. During the period of checking or cessation of growth of the rats the decrease in food intake was found to be only moderate and to offer only a partial explanation of the change in rate of growth, since, when calculated per 200 grammes of body weight, the amount of food consumed by the rats on the deficient diet was even larger than that consumed by the rats on the complete diet. During the same period the absorption of nitrogen and fat was not appreciably altered and could not therefore be the factor responsible for the checking of growth. In the last period of the experiment, when the appetite was greatly decreased, the decrease in food intake was probably the main cause of the loss of weight, this effect being augmented by the definitely decreased absorption from the alimentary canal observed during the last period. During the whole period of observation the nitrogenous metabolism was found to increase, and this increase in metabolism occurring simultaneously with the decreased food intake may check the normal growth of rats kept on a diet deficient in vitamin *A*. In such rats the increase in body weight was less than in rats kept on a complete diet when correlated with the same unit of food ingested. The author concludes that this would seem to be the chief factor in checking the growth of rats kept on a diet deficient in vitamin *A*.

Special Articles on Treatment.

(Contributed by request.)

III.

THE TREATMENT OF ACUTE NEPHRITIS.

General Measures.

REST in bed and comfort are the first essentials, and in the treatment of acute nephritis no pains should be spared to get the patient comfortable.

Such small matters as the position of a light, the stuffing of a pillow and the flow of fresh air are small matters, but they make greatly for a patient's comfort. There is no reason why his bed should not be on a veranda; if it provides a view of the outside world, so much the better for a child, and probably for an adult too. If the patient is to be kept warm, do it with light clothes; an eiderdown is better than blankets.

The electric hot pads now obtainable, if used intelligently (they must not be allowed to get wet), are immensely superior to the ordinary hot water bag.

Specific Antitoxic Treatment.

If, as seems probable,[1][2] acute nephritis is to be looked on as a general capillary injury due to a specific toxin (for example, of scarlet fever), it is possible that in this disease at least the use of an appropriate antitoxin would be of value. So far the use of scarlet fever antitoxin is too new to say whether this is the case or not.

Prophylactic Use of Alkalis.

Osman[3] holds that there is a predisposing factor in acute nephritis in the shape of: (i) a preexisting acidosis or (ii) an unstable condition of the acid-base equilibrium, so that acidosis is readily induced. Hence he uses alkalis in large quantities in such diseases as scarlet fever and acute tonsillitis to exert a protective action on the kidneys. There is, he holds, in these diseases a period of secondary acidosis starting about the twelfth day and continuing for several weeks. He uses the following:

Potassii citratis.
Potassii bicarbonatis.
Sodii citratis.
Sodii bicarbonatis ana 1·0 gramme (fifteen grains).
Aquæ menthæ piperitæ.
Aquæ chloroformi ana ad 30·0 mils (one ounce).

Twelve grammes (three drachms) of the total alkali are given daily, and the dose is increased till the urine is constantly alkaline, up to 60 grammes (1,000 grains) being given daily. Tetany, which may occur, is treated by injections of 1% calcium chloride solution. The illogical nature of this solution with its high sodium content is a curious oversight.

Detailed Treatment.

In discussing the detailed treatment of acute nephritis it is necessary first of all to recall the pathology of the condition.

McNee[4] showed that the primary lesion in acute nephritis is a swelling of the glomerular epithelium, so that tufts become transformed into enlarged hyaline masses—and this swelling effectively interferes with the passage of blood through them. Here we have a condition in the afferent vessels exactly comparable to that occurring in any area of infarct, vascular stasis, death of the tissues and tissue invasion by round cells derived in part from the fixed cells of the area and in part from the blood vessels.

The functional effect is, of course, first, a great diminution of urine. Next follows the death of many tubular cells, which are extruded as epithelial casts; then occurs the filling up in time of the spaces from which these have been swept by exuded blood cells, to be thrown out in turn as blood casts. Even such tubular cells as remain are too profoundly disturbed by the circulatory changes to discharge their essential functions, and so the excretion of other substances besides water, which maintains the delicate biochemical balance of the blood, diminishes partly or wholly.

Chief among these substances are those which maintain the acid-base balance; the normal urinary acidity is evidence of the constantly working tendency to acid preponderance in the blood stream, kept down by withdrawal of acid radicles.

Of the other retained products urea is in itself of comparatively little importance; its quantity may rise to hundreds of milligrammes *per centum* without any directly poisonous effects. There are other poisonous products which the kidneys should excrete and which are conjectured to be the cause or causes of the general manifestations of acute nephritis. Of these only one has ever been even approximately isolated; this was done by Nellis Foster[5] ten years ago and his work has never been repeated. What is certain is that many of the retained substances are the end-products of protein metabolism.

In addition, probably owing to the non-secretion of water, there arises a vascular plethora, with resulting blood pressure increase. The hæmorrhage through the damaged kidney is quite insufficient to relieve this, and the rise may be sufficient to cause grave cardiac embarrassment.

We have therefore in acute nephritis: (i) a retention of water, due to inability to excrete, with (ii) a resulting plethora and high blood pressure; (iii) retention of nitrogenous metabolites, other than urea, among which may be found general and local poisons; (iv) probably the retention of the actual causative toxins, such as those of streptococcal or other origin; (v) the vascular plethora acting on vessel walls damaged by circulatory toxins may be the cause of œdema; (vi) circulatory failure and nervous symptoms, coma or convulsions, possibly due to (iv), equally may be due to (v) causing areas of localized cerebral œdema.

Treatment must be directed to dealing with these conditions:

First, by limitation of raw material: (i) the limitation of fluid intake, (ii) the limitation of nitrogen intake, (iii) the diminution of body metabolism, which is in part a protein metabolism, (iv) the maintenance of the acid-base blood balance.

Second, by using other channels of excretion to relieve the kidneys: (i) fluid elimination by skin action, purgation and venesection; (ii) nitrogen elimination; this we can influence very little.

Third, stimulation of the kidney to resume secretion by medical or surgical methods.

Limitation of Fluid Intake.—Of measures enumerated, the most obvious is the limitation of fluid intake. If the kidneys cannot get rid of fluid, the balance will pile up in the blood and tissues as œdema and hydræmia, so adding to the patient's difficulties. The amount of restriction of fluid will, of course, vary with the conditions under which the patient is being treated. In hot weather the patient will demand more than in cool weather, and more if going about than if kept still. Thus during the period of oliguria the amount may be limited to the amount of fluid passed the preceding day.

Later, when the amount of urine is increasing, more may be given, but more than two litres (three and a half pints) daily is not advisable. The old use of large quantities of fluid in order to "flush out the kidneys" was based on the belief that the tubules were blocked by casts, blood and cell fragments; as it is now known that the real block is in the glomeruli, no useful purpose can be served by the treatment.

Volhard (quoted by Fishberg[6]) goes even further, to the point of almost complete exclusion of fluids and all food, cutting the daily intake down to two cups of tea and a little fruit. Fishberg states that he has used this method with great success, but it would spell cruelty in an Australian summer.

A further modification introduced by Volhard, should there be no improvement after a few days of thirst and starvation, is to give the patient 1,500 cubic centimetres

of fluid to drink in three-quarters of an hour. He bases this treatment on his conception of acute nephritis as due to a spasm of the arteries. Other writers are very dubious of its value; and its pathological basis is open to question.

Limitation of Protein Intake.—The limitation of protein intake is an obvious procedure. All protein end-products are excreted in greater part by the kidneys, some by the kidneys only, and they add an unnecessary burden to the kidneys' work. Especially is this the case should there be an oliguria, where the task of excreting a urine with nitrogenous constituents much higher than in the blood (for example, urea 2,000 to 3,000 milligrammes *per centum* in the urine against a maximum of 300 to 400 in the blood) involves very considerable chemical work.

A certain amount of excretion of these end-products there must be, as breakdown from the body cells, but the body can live for some days at least without outside protein. This metabolic waste may be largely diminished by rest in bed and limitation of physical effort.

In contrast, fat and carbohydrates have as end-products carbon dioxide and water, eliminated by other channels.

The Acid-Base Equilibrium.—The maintenance of the acid-base equilibrium is a matter of much importance. Failure to do so may lead to an acidosis of real gravity. The disturbance is due to two main factors, diminished excretion of anions (the acid radicles) and the failure of the kidney to form ammonia. Osman[3] has suggested treating the condition by liberal doses of alkalis.

It is important to notice that sodium salts must not be used, as it has been definitely shown by Blum,[4] Leiter,[5] and Shelbourne and Egloff[6] that it is the sodium radicle which is hydropigenic.

The potassium radicle, on the other hand, is not; therefore, potassium citrate and tartrate, owing to their weak acid radicles, are the salts to be preferred.

Thus the dietetic treatment of acute nephritis in the early stages may be summed up: (i) Limitation of fluid as far as compatible with the patient's comfort; (ii) limitation of foods to carbohydrates, fruits being especially useful in this respect; (iii) the addition of potassium alkalis to drinks.

At this point the question of milk is to be considered. Roughly, the composition of cow's milk is carbohydrate 5·0%, fat 3·5%, protein 3·5%. Thus to secure 5·0 grammes (75 grains) of carbohydrate (that contained in one "Sao" biscuit or one and a half teaspoons of sugar[7]) the patient must take 100 cubic centimetres (roughly three and a half fluid ounces), while the amount of protein is unduly large. Milk was satisfactory enough when the flushing-out *régime* was practised; it should nowadays have no place in the treatment of acute nephritis in the oliguric stage. Moreover, milk contains 0·16% of sodium chloride, which is best kept down in all forms of œdema.

Elimination of Excess by Other Channels.—The elimination of excess by other channels formerly was carried out in two ways—diaphoresis and purgation. Neither is used so vigorously as formerly, and some writers use them but little. Both may be carried to a point exhausting to the patient, purgation especially. Diaphoresis with hot packs and radiant heat may constitute a very pleasant and refreshing measure, but its use is to be judged entirely by the patient's reaction. Pilocarpine is seldom a necessary adjuvant. Purgation, by the administration of large doses of drastic purgatives, is upsetting alike to appetite and comfort, and should not be used. One or two regular evacuations by means of saline aperients is all that is necessary; but the oxide, carbonate or citrate must be used and not the sulphate.

Of quite another sort is venesection. Its mode of action is uncertain; of its effectiveness there can be no doubt. The removal of 500 to 750 cubic centimetres of blood can relieve a panting, dropsical patient, cut short a uræmic attack, and paradoxically reestablish a suppressed urinary flow. It is the most valuable measure we know in uræmia and should be then freely used in combination with lumbar puncture.

In heart failure it is of far more value than any cardiac stimulant, though digitalis, caffein and, more lately, "Coramine" have their advocates.

Stimulation of the Kidney.—Stimulation of the kidney to resume secretion is not possible until the acute stage is subsiding. Volhard's heroic fluid stimulation has been mentioned, and other diuretics, such as caffein, theobromin, "Diuretin", have no effect. The mercurial diuretics, "Novasurol" and "Salyrgan", are strongly contraindicated. The danger of retention and mercurial poisoning elsewhere, for example, in the bowel, must be added to the actual nephrotoxic effect of mercury.

In those cases in which a stubborn oliguria is maintained with œdema and hæmaturia, surgical measures have been used. In these cases decortication of the kidney is successful sometimes. It is a measure of last resort in these cases.

Attempts at removal of the source of the toxin in definite throat infection have been made. Theoretically, tonsillectomy should be at once effective; practically, the result in almost every case, even where the kidney condition seems to have settled down well, is an acute exacerbation. The same criticism applies in a less degree to the treatment of sinus infections at this stage.

Tonsillectomy is essentially an operation for very late convalescence, if at all.

The Stage of Convalescence.

The acute oliguric stage being past, the stage of convalescence requires much care.

The essential point in treatment is again dietetic. With the kidneys again acting well there is a profuse excretion, usually of low concentration urine, with a steadily diminishing protein content and blood disappearing; casts are progressively less common.

Carbohydrates will again be the staple diet, but the amount of water may be increased and fat in the shape of cream and butter freely added.

Protein must be also given, the amount should be small. The minimum requirement for a basal metabolic rate, 0·6 gramme per kilogram of body weight, should be enough to begin with. But it must be remembered that there has been a considerable degree of protein loss, so that the body requires more than a merely "basal" allowance; probably 1·0 to 2·0 grammes per kilogram will be necessary.

In what form should this be given? Should it be as milk? Now in a 63 kilogram (ten stone) man a basal protein ration would be 42 grammes, that is, 1,200 cubic centimetres, of milk, but the caloric value would be only 800—about half the total basal requirement. Therefore, if milk is used as the basis, it must be freely supplemented with cream, sugar, fruit and other carbohydrates.

Purin bodies contribute little to the protein requirements of the body, therefore the high purin foods, such as liver, sweetbreads, clear soups and beef tea, are best omitted.

Of the other protein foods it apparently is a matter of indifference whether the protein comes from eggs, white meat, red meat, fish or fowl; the essential fact is that it is all protein, and its two attributes should be attractiveness and digestibility. For certainly at this stage it is most important to remember that the diet should begin to be appetising and attractive. As Hippocrates says: "Food or drink which is a little less good but more palatable is to be preferred to such that is better but less palatable."

There may be a slight return or increase of the albuminuria on increasing the protein intake, but so long as no blood or casts appear, this may be disregarded.

General Treatment of the Convalescent Stage.—The question of stay in bed is a most difficult one. It depends on a number of circumstances and each case must be judged on its merits. At least, however, it is certain that the patient must stay in bed till all active signs of the disease have disappeared, though this may take weeks or even months. Albuminuria alone is not an absolute bar, but the presence of blood or casts should make for long hesitation. Always the effect of rising on the urine must be checked; a mere increase in albuminuria usually matters little, but a return of blood and casts calls for delay.

Although McLean's work showed quite conclusively that neither cold nor wet played any part in the production of acute nephritis, yet it is certain that many of these

patients improve rapidly, if for some time after their illness they can live in a warm climate in the open air.

Unfortunately, the acute stage does not always pass on simply to convalescence and recovery, but in a small proportion (about 1% de Wesselow suggests) passes on into a nephrotic form with œdema, oliguria, massive albuminuria, hypercholesterolæmia, low blood protein, but with no hæmaturia or nitrogen retention.

Here again the treatment is essentially dietetic, with limitation of fluids, of salt and of fats and instead with very large quantities of protein—up to 2·0 to 4·0 grammes per kilogram of body weight. The mercurial diuretics are to be avoided, but urea and ammonium chloride are helpful. The details of this treatment belong, however, more to the care of chronic nephritis.

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British Medical Association News.

SCIENTIFIC.

A MEETING OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held in the Medical Society Hall on April 6, 1932, DR. B. MILNE SUTHERLAND, the President, in the chair.

Genito-Urinary Tuberculosis.

DR. HAROLD MOORE read a paper entitled: "Problems in the Diagnosis and Treatment of Genito-Urinary Tuberculosis" (see page 137).

DR. MURRAY MORTON offered his congratulations to Dr. Moore on his excellent paper; he was glad to see that Dr. Moore had stressed the clinical side. In general he agreed with Dr. Moore's conservative attitude. He remembered one patient of his own who was suffering from advanced tuberculosis of one kidney and definite signs of tuberculous infection, including pyuria and tubercle bacilli, in the other. He had removed the right kidney and the patient had recovered completely. In another case he had been compelled to be conservative. The patient suffered from kyphosis and had renal tuberculosis. Owing to the spinal deformity, he could not approach the kidney through the loin, and he also failed to do so by the abdominal route. This was twenty years ago, and the patient was treated conservatively, and still came to see him. She had married after the menopause.

DR. W. J. BEVERIDGE said that he had had some experience of genito-urinary tuberculosis in sanatorium cases, 60% of which were in a condition too advanced for satisfactory sanatorium treatment. He asked Dr. Moore if he had made any observations on blood pressure in patients suffering from genito-urinary tuberculosis.

DR. BASIL KILVINGTON, in discussing the after-results of nephrectomy, said that he thought the outlook was better in women than in men. Two of his patients had been apparently cured and had remained alive after intervals of many years—one twenty years and one twelve years—but the latter some years later developed tuberculosis of the sacro-iliac joint. These had both been women. The outlook in men was less promising. He had removed a tuberculous left kidney from a man nine years ago, but since then the patient had developed infection of his prostate, seminal vesicles and epididymis, which caused him much disability.

PROFESSOR WOODRUFF said that the Bacteriological Laboratory of the Melbourne University could offer some assistance in the diagnosis of tuberculosis. Vernes's test had been introduced as a means of diagnosing syphilis, and was also useful in the diagnosis of the tuberculous infection. By this test a flocculation occurred in the blood serum taken from a tuberculous patient after some hours' fasting to prevent cloudiness. Without going into details, it might be said that Vernes's test was of some value in estimating post-operative or other therapeutic results. He thanked Dr. Moore for his very excellent paper.

DR. ALAN HAILES agreed in advocating radical treatment for unilateral renal tuberculosis, but asked Dr. Moore to what extent the existence of proved genital tuberculosis influenced him (Dr. Moore) in the treatment of renal tuberculosis.

DR. KEITH HALLAM expressed appreciation of the paper and, in discussing radiological diagnosis, said that Dr. Gilbert Scott, the late Director of Radiological Clinics at the London University, insisted upon two points: first, the smallness of the affected kidney compared with the other side, and, secondly, the fact that one could actually see the tuberculous lesions in the radiogram in the cortex of the affected kidney. Intravenous pyelography was not of much assistance in these cases, except when there was a considerable degree of dilatation of the ureter or pelvis and the kidney. The selective compounds were secreted entirely by the glomeruli, and as the latter usually escaped infection in renal tuberculosis, the renal function appeared reasonably good by intravenous pyelography methods, differing in this respect from the effects produced by pyonephrosis.

DR. J. KENNEDY congratulated Dr. Moore and asked whether he always gave a general anæsthetic in cystoscopy and also whether he had ever known shock to follow the intravenous use of indigo-carmine. He (Dr. Kennedy) always suspected renal tuberculosis when chronic pyuria occurred in a young man, even though tubercle bacilli were not found in the urine. He doubted whether the value of surgical operation in unilateral tuberculosis when any other active tuberculous focus existed.

DR. ELLIOT TRUE cited the history of a young woman at the Women's Hospital, who was suffering from tuberculosis of the spine of long standing and had old healed sinuses. She came in for Cæsarean section. After a few days she developed a mass in one loin, which was opened and from which pus was evacuated. She died a few days later. *Post mortem* an old extensive tuberculous pyonephrosis was found on both sides, and very little functioning renal tissue, far less than could be expected to support pregnancy.

DR. A. E. COATES quoted the case of a patient at the Melbourne Hospital, from whom a tuberculous kidney had been removed. He later developed a tuberculous prostatic abscess, which had improved with diathermy to the interior of the bladder.

Dr. Moore, in reply, said that in his opinion it was always worth while to remove one kidney which was severely involved in tuberculous infection, even when the other kidney was slightly involved, as such a procedure usually gave at least some relief to the symptoms. He had no accurate records of symptoms complained of, but he agreed with Dr. Kilvington that the outlook in women was better than in men. He had no personal experience of the value of Vernes's test.

In reply to Dr. Hailes, Dr. Moore said that he preferred to do a nephrectomy in unilateral renal tuberculosis, even when there was tuberculous disease elsewhere in the body.

Since writing his paper, he had seen a patient who had been subjected to nephrectomy and colectomy for tuberculous disease and was now surprisingly well.

In reply to Dr. Kennedy, Dr. Moore said that he preferred a local anæsthetic for cystoscopy, but did not hesitate to use a general anæsthetic when indicated. He had not noticed any occurrence of shock after using indigo-carmine.

NOMINATIONS AND ELECTIONS.

THE undermentioned has been nominated for election as a member of the New South Wales Branch of the British Medical Association:

Huntley, Ralph Clifford, M.B., B.S., 1930 (Univ. Sydney), 41, Francis Street, Kogarah.

Hospitals.

THE MENTAL HOSPITALS DEPARTMENT OF NEW SOUTH WALES.

A DEPARTMENTAL clinical demonstration was held at Broughton Hall Psychiatric Clinic, Sydney, on May 12, 1932. A series of patients was shown and their condition was described.

Neurosyphilis in Husband and Wife.

A man, aged fifty-two, and a woman of sixty years were husband and wife. Both of these patients showed evidence of involvement of the central nervous system due to syphilis, but it was difficult to determine in which one the infection was first contracted or whether they represented two different infections. Both denied any knowledge of the origin of their trouble, and in neither case had there been any manifestations of secondary lesions.

The husband had always enjoyed good health prior to the onset of the present condition. He had been married previously, but divorced his first wife for misconduct while he was on active service. He was an engine-driver and had been successful at this until about four years ago, when he began to live extravagantly and to spend his money as quickly as he earned it. Two months ago he complained of loss of power in his right hand, and this extended to the arm and finally involved the muscles of speech. This condition lasted only for about half an hour, but four days later he had a similar attack and he was admitted to the Mater Misericordiæ Hospital, where he was found to have a blood urea content of 160 milligrammes per 100 cubic centimetres. While there he had several similar attacks during which he was unable to walk. He did not lose consciousness at any time, but on one occasion his vision became blurred. His speech had become impaired and he found it difficult to express himself.

On admission to hospital he was somewhat confused and irresponsible in demeanour, but quite cheerful and rather euphoric. He exhibited considerable impairment of remote memory and to a less degree of recent memory. His speech was hesitant and slurred, and his facies was suggestive of *dementia paralytica*. His lips and tongue were tremulous, the pupils unequal, reacting sluggishly to light, and his knee jerks were sluggish also. The systolic blood pressure was 170 millimetres of mercury and the diastolic 110 millimetres. The blood urea was found to be 60 milligrammes per 100 cubic centimetres. The Wassermann test gave no reaction when applied to the blood, but his cerebro-spinal fluid showed a characteristic reaction, the Wassermann reaction being positive; the cells numbered 31; the results of the globulin and Takata Ara tests were positive, and the bicolour guaiac curve was 1444444410.

Shortly after admission he become very restless and unsettled and at times threatening in manner. He was extremely confused and incoherent in speech and his general condition showed no improvement. He was eventually certified as insane and sent to Callan Park.

The wife, who was eight years older than the husband, had had a pregnancy six years before the marriage. She did not know what had become of the child. She was married ten years ago, shortly after the menopause. Her health had always been good until about five years ago, when she noticed that she was becoming unsteady and her legs felt weak. The onset was so insidious that she was unable to give a clear history of the early symptoms. The condition became progressively worse, and two years ago her vision became impaired and had remained bad ever since. She frequently had diplopia and had noticed that her right pupil was "fixed". She consulted an optometrist, who told her that he was unable to remedy the trouble. She felt a tendency to fall forwards, and this was pronounced when her eyes were closed. She became suddenly deaf nine years ago. She was unable to get about without the aid of a walking stick, because she would fall if unsupported. There was a slight degree of impairment of remote memory, but otherwise her mental condition was quite good.

Her general condition was satisfactory, but examination of the nervous system revealed impaired vision, the vision of the right eye being $^{3}/_{36}$ and that of the left $^{6}/_{12}$. There was some pallor of both optic disks, more marked on the right side. The pupils were unequal, the right one being the larger, and both were inactive to light. There was a nerve deafness in both ears, and the result of the Rinné test was positive. A fine tremor of the tongue was present. Cutaneous sensibility was good, but deep sensibility and the sense of passive position and movement were impaired on both sides, more markedly on the right side. She walked with the legs held rather rigid and the toes dorsiflexed on a rather wide base, having a tendency to fall forward. There was no spasticity or excessive myotatic reaction. Coordination showed some impairment, and this was more pronounced on the right side. Rombergism was present. The knee jerks were absent and the plantar response was indefinitely flexor with a movement of withdrawal.

This patient's blood did not react to the Wassermann test, but the Kline reaction was "1". The cerebro-spinal fluid showed an indefinite reaction to the Wassermann test, only four cells were counted, and the globulin, Takata Ara and the bicolour guaiac tests gave no reaction. Since her admission she had been quiet and pleasant, anxious to cooperate in every way, and showed no evidence of the mental deterioration which was so marked a feature in the case of her husband.

Congenital General Paralysis.

A boy of seventeen years had shown a very definite change in personality over a period of twelve months. He was formerly a bright and pleasant boy who had done quite well at school, passing his qualifying certificate examination between the ages of twelve and thirteen, and was of average intelligence at least. He had had no serious illnesses except appendicitis and was always healthy and strong, with normal interests and amusements. He was knocked down by a motor car twelve months ago, but sustained no serious injury. Both parents were apparently in good health, the father being thirty-nine and the mother thirty-eight years of age. He was the eldest in a family of three, and was born two years after marriage. He weighed fourteen pounds at birth, which was an instrumental delivery. His mother had only one miscarriage, which occurred between the births of the second and third children. The other two children were quite healthy. For the past three years the patient had been working at the abattoirs with his father and had carried out his duties satisfactorily. Lately he had become very unstable and querulous, finding fault with everything, and his parents noticed that he was very tremulous. He complained of sensations "like electricity" in his limbs and trunk, but otherwise felt very well.

It was pointed out that he was very dull and apathetic and lay in bed indifferent to his surroundings. He was fatuous and euphoric, and stated that he was very clever and made a success of anything that he took up. He admitted hearing "voices", which said pleasant things to him and sang brightly. At times his speech was quite

unintelligible and it was very slurred and hesitant, and he was incoherent and rambling in conversation. He exhibited considerable poverty of ideation, was disoriented; his memory for both remote and recent events was greatly impaired.

Physically he was of poor development. His blood pressure was 160 millimetres of mercury systolic and 108 diastolic, and the heart sounds were loud and forcible. There was a coarse irregular tremor of the tongue and occasionally of the lips also. His speech was extremely incoordinate and there was a slight degree of bilateral ptosis, more pronounced at some times than at others. His pupils were of moderate size and equal, but failed to react to light. There were no sensory changes, but a coarse tremor of the fingers and of the extremities with voluntary movement was present. Knee jerks were exaggerated and "floppy" in type.

Dementia Following Severe Burns.

A boy, aged sixteen years, showed considerable intellectual deterioration while remaining pleasant, even tempered and well conducted. His development was normal until the age of fourteen. He had been a good scholar and showed considerable promise. At the age of fourteen he was severely burned about the lower part of the abdomen, left thigh, both hands and the right ankle by the explosion of a tin of methylated spirits which he was pouring into the lighted cup of a primus stove. He was in hospital for five weeks, and during part of this time he was delirious. On his discharge he was noticed to have strong religious tendencies, which lasted for a short time only. After that he became very childish and had silly laughing fits, which he was unable to control. There had been some improvement in that respect during the previous few weeks, but he liked to associate with small children, doing sums and playing school. He was simple in demeanour, rather dull and apathetic, with a gross impairment of orientation and considerable poverty of ideation. His memory for remote events was rather faulty; he could not concentrate on questions and was slow in comprehension. His mental age, determined by the Binet-Simon method, was ten years and nine months. His intelligence quotient was 67; this low result was largely due to his inability to remember figures and to exercise initiative in the solution of simple problems while his vocabulary remained quite good.

He was a well made youth, in good physical condition, and nothing abnormal was detected on physical examination. No history was obtained of psychopathy in other members of the family.

Schizophrenia.

A boy of seventeen years had a history of a change in personality. This was noticed about nine months ago, when he began to express exalted ideas about his ability and became foolish and irresponsible in manner. He complained that he was being watched through a telescope by two girls who lived opposite him, and at times he was quite incoherent in speech, repeating the same phrase over and over again. During the past few months he had become very shy and reserved and refused to meet people. He said that girls followed him wherever he went, and whistled to him. He was frequently restless at night, and on one occasion he rode a neighbour's horse, bareback, up and down the road in the middle of the night. He believed that people were talking about him and criticizing him. Lately he had become very dull and spent most of his time lying in bed, indifferent to all that went on around him.

On admission to hospital he was found to be rambling and incoherent in speech, with a tendency to verbigeration and echolia. He continually repeated the words "mystery of life". He expressed ideas of reference and was hallucinated, complaining that people were making "squeaking noises" at him. He was garrulous with some press of ideation and irrelevance, but showed little affective response to his condition. Memory and orientation, however, remained quite good. The family history was clear. He was the fifth in a family of seven and, except for defective vision in the left eye, which developed at the age of three, he had always been strong and healthy. Six years ago he fell from an omnibus and struck his head on the ground and sustained concussion, but the skull was not fractured. He was in hospital for three weeks. Since leaving school he had worked with a book company. He was highly thought of by his employers until eight months ago, when his irresponsible behaviour resulted in the loss of his position. Until the onset of the present condition he was bright and happy and quite well adjusted socially.

His general physical condition was satisfactory, although his systolic blood pressure was 152 millimetres and the diastolic pressure 100 millimetres of mercury.

Conversion Hysteria.

A female, aged thirteen years, was the third of five children. All were healthy. She was a healthy baby, was unusually placid and wore the hair off the back of her head from lying in one place. She was never known to cry. She did not walk until well after two years and was backward in talking. As a child she was very timid and easily frightened. She was of considerable annoyance to her parents in always crying when taken in tram or train. At school she was dull.

Her present illness dated back to when she was nine years old. She had a severe shock. She was crossing the road with her small cousin when a passing motor car killed her cousin. The patient says that she can remember "her brains being picked up". The patient ran straight home and was very white and could not speak. A boy later told her mother what had happened. She would not tell the police anything, she said she was too frightened. They saw her a few times without any satisfaction.

The following week her mother sent the patient back to school. She seemed very excitable and was easily upset. She would cry for anything. About twelve months after the accident the patient was noticed to run backwards when her schoolmates called her. Six months later the teacher advised her mother to take the patient from school. She said the patient was continually falling over and was likely to hurt herself. The patient had not attended school since. She stayed about the house and would not go out or play with the children. She had frequent turns, when she stiffened out, raised her right arm and ran backwards. She would only walk a short distance without support. As soon as she heard a footstep the patient became tremulous and unsteady. When visitors came to the home the patient would not leave her chair.

On admission to hospital the patient presented the appearance of a young girl very infantile in development. She held the right arm slightly flexed at the elbow. There was some wasting of muscles of the forearm and hand. General physical examination revealed no abnormality. All reflexes were increased. The right arm was slightly rigid and very tremulous. Her gait was uncertain, and she could walk only a few steps without support, on account of well marked retropulsion. She frequently threw her head backwards, got up on her toes and at the same time made some movement of her right arm upwards. She was very easily upset and cried readily at times during the examination. With the Binet-Simon test the patient gave a mental age of eight years and ten months, with an intelligence quotient of 63. There had been some slight improvement since admission. The patient was brighter and less emotional. She bathed and dressed herself without any difficulty when not noticed, but under observation became very tremulous and walked a few steps, then stiffened herself up and tended to run backwards.

Congenital Moral Defect.

A female patient, aged sixteen years, was the youngest of three children. Her father, who was killed at the war, was an alcoholic and cruel. Her mother was a diabetic. There was much evidence of emotional instability in the father's family; the grandfather was an alcoholic and violent tempered, an uncle alcoholic, an aunt insane, and a first cousin very irresponsible and alcoholic. The maternal grandmother was a diabetic; three of the grandmother's children and the grandfather died of asthma. An aunt was mentally defective. Of the patient's two brothers the elder was dull, the younger a roamer and a pathological liar.

The patient had a healthy infancy and uneventful childhood until seven years of age, when she was treated for "sunstroke". She was delirious for a few days, running a high temperature. She had recovered in a fortnight. She attended school up to fourteen years, when she failed in the qualifying certificate examination. She was a dull scholar and frequently truanted. On leaving school she was apprenticed to tailoring, but five months later was dismissed because her work was unsatisfactory. The patient would be sent on a message and would not return for the rest of the day. Later she got work as a factory hand, but had trouble with the foreman and was put off. She had not worked for a year and had been attending night classes at the Technical College.

The mother stated that the patient had never acted in a responsible manner. As a child she was very excitable and untruthful. She would take things from the home, and on one occasion stole ten shillings. From school the mother had nothing but bad reports of her progress. Instead of going to school the patient would spend the day in the picture show. She took no interest in her lessons. She was just as unsatisfactory in employment, so that the mother had to keep the patient at home.

One year ago the patient did not return home for three weeks. She did light domestic work for a woman, to whom she told a tale of her life at home as being unhappy. Another time the patient slept in the doorway of a shop and arrived in the early morning at a relative's home in a young man's car; she told them her mother had sent her for a holiday. The patient seemed always to be unsettled at the menses. She had also borrowed money in the mother's name. Two months ago the patient was taken to Saint Vincent's Hospital after she had made a mild suicidal attempt—she drank some diluted lysol because her grandmother had scolded her for her waywardness. While at hospital the patient was found to have contracted gonorrhœa and still gave a positive smear. The mother had been told that the patient used bad language and smoked.

The patient was a young girl, well developed and in good physical condition. She was bright and cheerful and discussed her frequent wanderings away from home and her untruthfulness with candour and without any embarrassment. She gave a colourful description of her suicidal attempt, the facts of which were discounted by her mother. Her mental age was 13. She was sent to hospital with a provisional diagnosis of post-encephalitic moral defect.

Chronic Chorea.

A man, aged forty years, a musician, was married, with three children. He gave a history of progressive unsteadiness in gait, associated with the development of irregular choreiform movements. The first thing noticed was that, about six years ago, he was moving his fingers in a jerky fashion, involuntarily. Two years later a relative commented on the "drunken walk" that he had developed, and he found that he had difficulty in playing the trombone. On one occasion he was accused by his bandmaster of being intoxicated. He became very clumsy and at times fell over, and his unsteadiness was now so pronounced that he was arrested for drunkenness. Associated with this physical condition there was a change in temperament and he became irritable and quarrelsome, and his manner at times was so threatening that his wife had to seek police protection. During the past three years he has been unreasonably jealous, accusing his wife of infidelity (resenting even her attentions to their sons). At times she had had to leave the house and walk about the streets until he recovered from his outbursts of anger. Eighteen months ago his movements became progressively worse. He had found difficulty in concentrating and began to lose interest in himself and would not shave or keep himself clean. He had also become rather dull, with some impairment of memory, and was depressed at times.

There was no family history of any similar condition, but he knew little about his relatives, except that one brother, whom he had not seen for sixteen years, was in a charitable institution in England; he had been hemiplegic from birth.

This patient had always been strong and healthy. He was the younger of two and spent his early life on a naval training ship from which he deserted in Sydney to earn his living as a musician in various orchestras. He had three children, boys, whose ages were sixteen, fifteen and six years respectively. All were in good health. He admitted moderate potus, but denied venereal infection. His blood did not react to the Wassermann test.

Physical examination revealed no abnormality in the cardiac, respiratory or urinary systems. His general condition was good. He showed irregular, grimacing movements of the facial muscles; his speech was somewhat hesitant and "thick", but his pupillary reactions were normal. He tended to reel in an ataxic fashion when walking, but this was apparently largely due to the irregular movements which were present. The limbs and trunk were affected by choreiform movements, but there was no loss of power. His tendon reflexes were increased and the plantar responses were flexor.

Mentally he was rather dull, with some impairment of remote memory. He experienced difficulty in concentrating on questions and tended to be irrelevant in conversation. Although he was at times mildly depressed, his general attitude was one of euphoria. He was restless and irritable occasionally, but was otherwise quiet, pleasant and amiable.

Hysterical Chorea Associated with Congenital Mental Deficiency.

A female patient was aged seventeen years. She was the youngest but one of six children. Her mother deserted her father when the patient was three years old, on account of the father's infidelity and alcoholic habits. From early married life the mother had supported the family, working hard as a laundress. There was a bad history of alcohol on both sides of the parents' families. The maternal grandmother died from methylated spirit drinking.

The patient was never a strong child, and at seven years of age had St. Vitus's dance. She was put in a home at ten years of age. Four years later the matron advised the mother to take the patient to a mental specialist; she thought there was something wrong with the patient's brain. She could not teach the patient anything; the patient was mischievous and a nuisance in the home; she had hysterical attacks and would bite herself and throw herself on the ground. The mother took the patient from school and one year later the patient became a factory hand. She worked for nine months, when she left on account of her health; she used to feel sick in the stuffy room. She had a few domestic positions, but was dismissed on account of her temper. She had not worked for a year. She lived at home with her mother and brothers and sister. She was never happy; she always seemed to be very discontented and was very irritable and bad tempered. She was unsociable and showed no inclination to take a position.

During the last few months the mother had noticed choreiform movements return in the patient. Movements had become worse. She had torn up several pillow cases and every book that was given her to read. She had become very difficult to put up with; she had outbursts of temper and threw things about. She walked out of the home and had one or two screaming turns.

The patient was rather a tall, pale-faced girl, with auburn hair; she was poorly developed. She was very fidgety and had irregular movements of the hands, feet and head. She was able to feed and dress herself. She was quiet and rather timid in manner; she had a mental age of eleven and a half years. She had been well conducted since her admission.

A female patient, aged twenty-five years, was married, with two children. She was an illegitimate child. The mother was said to have been very bad tempered. The patient was deserted by her mother when three weeks old and was adopted by a family. She had an unhappy childhood, with plenty of hard work. With the establishment of the menarche at thirteen years of age, the patient had her first attack of chorea. She had a recurrence the following year. She kept fairly well and was able to work

as a domestic. She was ill again at eighteen years of age, and had rather a severe attack; she could not speak. She had a "forced" marriage at the age of twenty-one and shortly afterwards, when five months pregnant, the patient had to be put in the Mental Hospital, Kenmore. The movements were very pronounced and were accompanied by marked mental instability. The patient recovered and the next attack was at the age of twenty-three, when she was six months pregnant with her second child. She was again in Kenmore in a padded room. This attack started six months ago, and she was treated in Kenmore for one month. She had to be fed, was depressed and expressed suicidal ideas. When she was admitted to Broughton Hall two months ago, the movements were not marked. She had continued to improve, but was still somewhat fidgety. She had a mental age of twelve years, was very cheerful, but rather untidy and indolent.

Delirium Cordis.

A man, aged sixty-five years, was admitted to hospital in a dull, apathetic condition, with a history of depression for a period of five months, due to financial difficulties. He seemed to improve a little after Christmas, but one week before admission he began to ask whether he had done wrong and said that he was dead. He was hallucinated and his relatives heard him carrying on a conversation with the "voices" which said derogatory things about him. Occasionally he was emotional, believing that he had been cremated. He lost interest in everything and was miserable and self-absorbed.

His previous health had always been good; he was a total abstainer and did not smoke. He was married, with seven children, all of whom were healthy. There was a family history of cardiac disease, his father having died suddenly at an early age from a ruptured aneurysm, and his mother at the age of fifty-five from the œdema of heart disease. There were no other known family tendencies.

He was a big man, in a well nourished condition, rather pale, with a slight malar flush and prominent venules on the nose and cheeks. The systolic blood pressure was 150 millimetres and the diastolic pressure 90 millimetres of mercury. The heart sounds were of poor quality, lacking tone, but regular. The vessel walls were palpable. The other systems were clear and the reflexes were normal.

Shortly after admission he became restless and confused, incoherent in speech, continually undressing himself, and he was resistive to any attempt to do anything for him. There was marked poverty of ideation, with great distractibility of attention. He expressed fleeting persecutory delusions, believing that he was to be cremated. He then relapsed into a stuporose condition, in which catatonia was present, and at one time he remained with his arms extended for almost an hour. This phase lasted only a short time and was succeeded by extreme restlessness and excitability, during which he threw himself about his room and struck his head on the window ledge and was aggressive in manner. This was followed in a few hours by a syncopal attack. He became collapsed, with a rapid, feeble, irregular and almost imperceptible pulse, stertorous respiration and marked cyanosis of the lips and cheeks. Stimulants were administered hypodermically and by mouth, and his physical condition soon began to improve. At the time of the meeting he was having a mixture containing digitalis and strychnine, with benefit. His pulse was regular and his colour was better, but he remained very listless, disinterested and unresponsive, and at times refused his food.

Correspondence.

MODERN OPTOMETRY.

SIR: The correspondence under this heading in recent issues of THE MEDICAL JOURNAL OF AUSTRALIA is important beyond the conventional use of that word. The matter at issue, it seems to me, is intimately related to the parallel debate on "The Future of the Medical Profession". They should alike be pursued until some finality of purpose and policy is reached. And this finality, I venture to suggest, must be based on a wider and more democratic examination of the matters at issue than has been given to the subject by the profession in the past. And while the facile suggestions of the irresponsible amateur are apt to arouse in the expert a not unjustified ire, it is also true that the man outside the scrap is in a position to form a dispassionate judgement on the matter at issue. In this spirit I venture to offer a few remarks, which shall be frankly provocative, both in tone and substance.

First, for the "optometrist". It is my own belief, arrived at through philosophic participation in medical practice and contemplation of social evolution over a good many years, that the situation demands inexorably from the medical profession (that is, the members of the community to whom is entrusted by law the maintenance of the public health and treatment of diseases) an account of its stewardship. For, whoever may be to blame, there can be no doubt—the occasion of the correspondence is indeed in itself proof—that the community (whose we are and whom we serve) has been imperfectly provided in the past in the matter of "optometrics"—in plain English, the measuring of the refractive error in defectively constructed eyes, for correction by lenses.

The defects of an arrangement that permits the carrying out of these measurements by optometrists have been fully and ably presented by various correspondents in your columns. But there is, I suggest, another side to the question; and here and now I submit that in great measure it has been the fault of the medical profession that the present situation has arisen.

1. In the first place, I submit that not more than 10% (ten *per centum*) of medical practitioners are able, and not more than 5% (five *per centum*) are willing to accept the responsibility of estimating correctly refractive errors that cannot be arrived at by the simple use of trial lenses.

2. As a consequence (direct or indirect) of this situation in the medical profession, a not inconsiderable section of the community has had forced on it one of three courses: (*a*) To pay for their "glasses" a sum of money that they consider excessive. (*b*) To sue to the profession *in forma pauperis* for free treatment. (*c*) To consult those who offer to estimate the refractive error with sufficient correctness and to supply appropriate glasses—frames and lenses—at a moderate cost, well under five pounds.

And only too often the citizen accepts the risk (what really, is the risk—1 in 1,000?) that the defect in his eyesight may be due to or associated with disease, and that the optometrist may be unable to detect the fact; and is measured by the man who makes the glasses. Sometimes, without doubt, he "falls in" and sustains serious damage; more often he is imperfectly provided—an event not unknown (as those of us who are inexpert, but honest, will acknowledge) when he obtains a prescription for glasses from a general practitioner. But in the majority of instances he gets what he wants at a moderate cost.

I submit, as a basis for conversation—which may turn out a *casus belli*—that in this aspect of its responsibility the official medical profession has not adequately supplied the demand. The community has sought it elsewhere, and we have done little else than pour obloquy on those who have taken advantage of the defect in our organization and have stepped into the breach. Acknowledgement of this has indeed been made in effect, if not explicitly, by Dr. Antill Pockley.

The medical profession, it seems to me, has lost sight of the fact that it exists to serve the community; that the community consists of others than the well-to-do and the pauper; and that there are quite a lot of "specialties", apart from ordinary common or garden illnesses, surgical and medical, for which the *paterfamilias* has to pay "fees" that must diminish the amount available for food, clothing, rent, schooling and income tax, let alone recreation and the family holiday.

To me it seems that from the point of view of the medical profession the solution of the problem must lie, first, in a candid recognition of our default; second, in

organizing the machinery of our profession and directing the evolution of its science and art in such a manner that the occupation of "optometrist"—"qualified" or "unqualified"—outside the medical profession will not be in demand (the only way to cut off the supply); and lastly, in a ruthless elimination of any tendency to profiteer on the monopoly that is the inevitable, though a secondary, consequence of the restriction of legally recognized medical practice to legally qualified practitioners of "medicine".

The introduction of special legislation whose purpose has been to restrict within trained bodies of men and women outside the "medical profession" certain aspects of medical practice has, it seems to me, in every instance come about in consequence of the inability or the unwillingness of medical practitioners to undertake such practice in a manner required by the community. Of such are the dental and the pharmaceutical "professions", and the service of "massage" (which latter appears to be developing along lines that will include beside skilled manipulation most forms of physiotherapy). Does, one may ask, the justification for a "dental profession" rest only in the fact that this medical specialty is concerned with defects in an organ that has been looked on in the past as of purely local significance, or at most as influencing rather than being influenced by constitutional disorders? Even the demand for registration of the exponents of various special and unorthodox forms of medical practice, such as homœopathy (now, it would appear, officially habilitated by the British Medical Association in Great Britain), herbalists, osteopaths, Christian Scientists, and so forth, has had its impetus in the lack of scientific medical education to the community, for which lack the profession must be held chiefly responsible; or else in an actual neglect by the official medical profession to exploit important potential lines of therapeutic intervention. The reasons for this neglect, though of great interest, are not necessary to the argument.

Future of the Profession.—It would almost seem that the future of medical education, with its enormous demands for specialization, the concomitant and equally prodigious rise in cost to the public, and the impossibility that any one practitioner shall carry out in practice effective service in each and every line of diagnosis and treatment, will lie in the formulation of and provision for a basic training in scientific medicine, which shall be both theoretical and practical, but confined to the fundamentals of medical science and art; an elementary knowledge of physics and chemistry; an adequate insight into the essentials of biological life; a sufficient knowledge of the structure and function of the human body and of the ways in which these may advantageously be influenced toward health, together with a similarly fundamental initiation into the biological features of "disease"; instruction in the various factors that enter into any departure from the normality of health; and scientific teaching in the action of therapeutic measures. Qualification in such a course would not itself carry registration; but from this primitive medical material of varying quality there would be selected, and would diverge along special lines of study and training, the general practitioner, the public health administrator, the specialist physician, pathologist, alienist, surgeon, ophthalmologist, dentist, radiologist, optometrist, and so forth. The physiotherapeutic specialist, for example, would himself carry out the massage, manipulations, electrical treatment, and the rest, that in the past have been a fetish to the profession and to the public alike.

These various specialties would necessarily vary in status and in the remuneration they should require for their services, depending on the scientific and technical skill and training demanded; but all would come within the honourable precincts of the medical profession. They would absorb a considerable proportion of the medical students who, after three to four years of medical study, have to abandon it, and would supply to the community (which still consists of every possible grade in human "wealth" and ability to pay) what it requires, at a rate not disproportionate to the cost of the fundamental necessities of life—food, clothing and housing—and such that all who at the time were self-supporting could "afford" to pay for the service, or would not be debased in receiving it free.

The alternative, it seems to me, will be in the total abolition of legal registration for the practice of any form of medical treatment, and the building up by the profession of a supremacy that shall be based solely on scientific and moral claims.

Yours, etc.,

A. G. BUTLER.

Duntroon,
Canberra, F.C.T.,
January 9, 1933.

THE FUTURE OF MEDICINE AS A PROFESSION.

SIR: Recent correspondence on "The Future of Medicine as a Profession" has furnished readers with many aspects of the problems which confront the medical profession in general, and with numerous suggestions of a remedial character.

Overcrowding of the profession and the drift to public hospitals have been the two major subjects under discussion, and a variety of methods to counteract these anomalies has resulted.

With regard to the drift to public hospitals, it appears to me that some of the causes have not been fully appreciated. It is, I think, becoming generally recognized by the public in need of medical treatment, that modern medicine demands a properly equipped institution for the purpose of conducting diagnosis and treatment. How often do we hear a prospective inmate say: "I will willingly pay for admission to the hospital", not realizing, maybe, until then that these institutions are primarily for the indigent sick, but knowing that here are the conveniences and equipment essential to meet modern demands. In addition, not a few, more astute or perhaps better tutored by their friends, have realised that one can obtain something for nothing at the expense of a little prevarication or mild perjury to the clerk at the admitting desk.

This last group will always be difficult to eradicate, but their numbers would no doubt be reduced if we had something attractive to offer them. These matters have often been discussed before, but few faults have been laid at the door of the doctor himself. It may be that it were wise to put our own house in order to commence with.

In the practice of medicine and surgery with all their allied specialties at the public hospitals, how often does it occur, either from goodness of heart or the enthusiasm born of his training, that the honorary undertakes treatment, operative or otherwise, for minor complaints which are of no real importance and are not causing ill effect to the patient, nor endangering his efficiency or his life.

If such individual desired a new hat or a new gramophone record, it would be necessary for him to save some of his earnings to purchase same; why, then, should he not save in order to have a sebaceous cyst removed from his face or to get his hay fever treated.

A countless number of minor operations and other forms of treatment for non-urgent minor complaints that take place in public hospitals annually should be done by the private doctor, and this ideal will be accomplished only when the honorary physician and surgeon take the stand themselves for the benefit of their colleagues in general practice and refuse to treat such patients at public institutions.

It is becoming more widely known every year that by paying the consulting fee of a city specialist a prospective patient can practically be assured of treatment by that same specialist at his hospital, provided he (the patient) can successfully gain entrance.

It is a very old custom and one that may have many advantages to the consultant, but is based on a wrong principle, with results which far outweigh the advantages. For the fee, then, the patient is not only able to gain the recommendation of a member of the staff, an admitted *entrée*, but he is able also to choose his surgeon or physician.

The treatment of accident cases covered by insurance is another problem too lengthy to enter into here, but one which in Victoria at least requires complete investigation.

The public demand modern, well equipped institutions, and rightly so. Cannot we as the medical profession help to supply them and so stop the drift to the public hospitals?

The self-supporting scheme inaugurated by Sir James Barrett—the Victorian Bush Nursing Association hospitals—applied to the capital, zoning it into appropriate areas and providing such zones with a modern private hospital, will help to meet the need.

Yours, etc.,

CHARLES H. OSBORN, F.R.C.S.

32, Collins Street,
Melbourne,
January 10, 1933.

Books Received.

A SURVEY OF SEXUAL LIFE IN ADOLESCENCE AND MARRIAGE, by R. V. Storer; 1932. Melbourne: Science Publishing Company; Melbourne, Brisbane and Christchurch: James Little. Crown 8vo., pp. 221, with six plates. Price: 15s. net.

Diary for the Month.

FEB. 7.—New South Wales Branch, B.M.A.: Organization and Science Committee.
FEB. 14.—New South Wales Branch, B.M.A.: Ethics Committee.
FEB. 21.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
FEB. 22.—Victorian Branch, B.M.A.: Council.
FEB. 23.—South Australian Branch, B.M.A.: Branch.
FEB. 28.—New South Wales Branch, B.M.A.: Medical Politics Committee.
MAR. 1.—Western Australian Branch, B.M.A.: Council.
MAR. 1.—Victorian Branch, B.M.A.: Branch.
MAR. 2.—South Australian Branch, B.M.A.: Council.
MAR. 6.—New South Wales Branch, B.M.A.: Organization and Science Committee.
MAR. 7.—New South Wales Branch, B.M.A.: Ethics Committee.
MAR. 14.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
MAR. 15.—Western Australian Branch, B.M.A.: Branch.
MAR. 15.—Victorian Branch, B.M.A.: Clinical Meeting.
MAR. 21.—New South Wales Branch, B.M.A.: Medical Politics Committee.
MAR. 22.—Victorian Branch, B.M.A.: Council.
MAR. 28.—New South Wales Branch, B.M.A.: Council (quarterly).
MAR. 30.—South Australian Branch, B.M.A.: Branch.
MAR. 30.—New South Wales Branch, B.M.A.: Annual Meeting.

Medical Appointments.

Dr. N. J. Bonnin, Dr. K. Brooke-Cowden, Dr. M. B. Cleland, Dr. L. A. Cock, Dr. K. F. Edwards, Dr. M. M. Flecker, Dr. W. E. Gallagher, Dr. J. H. Gray, Dr. J. L. Hayward, Dr. L. A. McLean, Dr. M. W. Miller, Dr. R. J. O'Connor, Dr. L. J. T. Pellew, Dr. C. W. R. Price, and Dr. H. M. Southwood have been appointed Resident Medical Officers at the Adelaide Hospital, South Australia.

* * *

Dr. F. A. Maguire (B.M.A.) has been appointed a member of the Board of Directors of the Royal Prince Alfred Hospital, Sydney, New South Wales, pursuant to the provisions of the *Prince Alfred Hospital Act*, 1902.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser", page xvi.

BRISBANE MATER CHILDREN'S HOSPITAL, QUEENSLAND: House Physician, House Surgeon.
CHILDREN'S HOSPITAL (INCORPORATED), PERTH, WESTERN AUSTRALIA: Junior Resident Medical Officers.
COMMONWEALTH OF AUSTRALIA: Medical Officer.
SYDNEY HOSPITAL, SYDNEY, NEW SOUTH WALES: Honorary Clinical Assistant.
TOOWOOMBA HOSPITALS BOARD, TOOWOOMBA, QUEENSLAND: Resident Medical Officer.

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company Limited. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane.	Brisbane Associated Friendly Societies' Medical Institute. Mount Isa Mines. Toowoomba Associated Friendly Societies' Medical Institute. Chillagoe Hospital. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL are advised, in their own interests, to submit a copy of their agreement to the Council before signing. Lower Burdekin District Hospital, Ayr.
SOUTH AUSTRALIAN: Secretary, 207, North Terrace, Adelaide.	All Lodge Appointments in South Australia. All Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 65, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND (Wellington Division): Honorary Secretary, Wellington.	Friendly Society Lodges, Wellington, New Zealand.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to "The Editor", THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2651-2.)

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